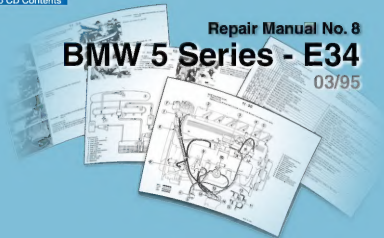


Repair Manual No. 8

BMW 5 Series - E34

03/95



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Foreword

This Repair Manual is intended as an aid in ensuring all necessary maintenance and repair work is carried out expertly and professionally. It therefore supplements the practical and theoretical training received by our managers and technicians in our service training centers.

As of model year 1985, Repair Manuals are subdivided into:

- Repair Manuals for the specific series

The Repair Manual (series 3, 5, 6, 7 and 8) describes removal and installation or replacement of components in the vehicle.

- Assembly Repair Manual for BMW automobiles

The assembly Repair Manual (main groups 11, 12, 13, 23, 24 and 33) describes the removal and installation or replacement of assemblies and removed equipment. The Assembly Repair Manual also includes notes on testing as well as troubleshooting tables.

The Technical Data microfiches is available as a reference for Technical Data (tightening torques, settings etc.)

The Repair Manual (microfiche) illustrates repair and maintenance jobs which can only be carried out on standard, i.e. not subsequently modified, vehicles.

The structure of the Repair Manual corresponds to the numbering system of the Flat Rates Catalogue (FRU numbers).

Cross references to other FRU numbers are intended only as an aid and should not be construed as an extension to the specified working time.

The page numbering 64 - 118 means for example:

- 64 - Main group
- 11 - Subgroup
- 8 - Consecutive page number

All special tools referred to in the Repair Manual are listed in the special tools microfiche, Order number 01 99 9 698-432. The use of special tools is illustrated where necessary in the relevant steps.

Generally, only the removal of components is described within the individual working steps in this Repair Manual, installation takes place in the reverse order of removal. If it is necessary to observe special procedures during installation, reference is made to them in the form of installation notes.

Deviating from this procedure, both removal and installation, are described separately for complicated jobs.

Service information bulletins will keep you updated with any improvements and modifications. As an additional source of information, we recommend the clearly illustrated parts microfiches.

BAYERISCHE MOTOREN WERKE AG
CENTRAL SERVICE DEPARTMENT - TECHNICAL

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00 Maintenance and general data

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BMW Maintenance System

The maintenance jobs apply up to model year 93. Refer to inspection sheet as of model year 94.

00 00 009	Pre-delivery check	00-	1
00 00 210	BMW running-in inspection (at 2000 km)	00-	5
00 00 220	BMW inspection I	00-	6
00 00 230	BMW inspection II = inspection I + following service work	00-	10
00 00 245	BMW annual inspection	00-	12
00 00 249	BMW engine oil service	00-	14
00 00 259	BMW safety test	00-	15
00 00 099	Replacement engine inspection after 1000 km	00-	16

BMW Maintenance System – USA

The scope of maintenance work remains valid until model year 93. From model year 94, refer to inspection sheet.

00 00 009	Pre-delivery inspection	00-	20
00 00 215	BMW running-in check at 1200 miles	00-	25
00 00 220	BMW inspection I	00-	27
00 00 231	BMW inspection II = inspection I + following additional work	00-	31
00 00 240	BMW annual inspection (intervals between 11 and 13 months)	00-	33
00 00 249	BMW engine oil service	00-	34
00 00 259	Additional work recommended against special invoice	00-	35
	BMW Lambda oxygen sensor service	00-	36
	BMW airbag system (SRS) check	00-	36

GENERAL INFORMATION

PRECAUTIONS FOR WORKING WITH PARTS CONTAINING ASBESTOS

Inhaling fine asbestos dust could impair health.

Conform with these safety precautions when working with asbestos parts.

- Only work outdoors or in well ventilated rooms.
- Only use manually operated or slow running equipment, with dust extracting equipment if necessary. Only operate fast rotating equipment with dust extracting attachments.
- Moisten parts prior to machining whenever possible.
- Never blow out leaks and clutch parts.
- Moisten dust, fill in containers which can be sealed perfectly and dispose in a manner which prevents danger.
- Asbestos waste and scrapped parts must be collected in perfectly sealed containers marked accordingly and then eliminated without danger for human beings or the environment.

Important when disconnecting battery!

To disconnect the battery, disconnect the negative lead from the ground connection. Disconnecting the battery will cancel fault memories of control units. Use tester to read out fault memories and print out data on any errors prior to disconnecting battery.

Work on components, terminal connections, etc. could result in errors being stored in the fault memories of the affected control units. If disconnection of the battery is specified in the Repair Manual for the carrying out of repairs, there must always be conformance with this in the interest of safety.

Windsheild wipers (wiper motor):

If a fault occurs, the intermittent wiper and wiper stage 1 are switched off with a block protection feature. This block protection feature remains effective even after the fault has been rectified. To cancel the block protection, switch off the ignition (terminals 15 and R) for 3 minutes.

Wipers (CPA motor) CPA = Contact Pressure Adjustment:

If a fault occurs, the CPA motor is switched off by a block protection feature. This block protection feature remains effective even after the fault has been rectified. To switch off the block protection:

1. Disconnect the battery for 30 seconds (caution: cancel fault memories in all control units) or
2. Automatic cancellation while vehicle is in motion.

Vehicle with interlock system:

If a component of the interlock system was removed and installed or if the installation position of the interlock cable was altered, the following function check must be performed:

1. Move selector lever on automatic transmission to "P".
2. Remove ignition key.
3. Press locking button on selector lever.
4. If the selector lever can be moved out of "P" setting, the interlock cable must be adjusted, refer to Qr. 25.
5. Switch on ignition.
6. Press locking button on selector lever.
7. If it is not possible to move the selector lever out of setting "P", the interlock cable must be adjusted, refer to Qr. 25.

GENERAL INFORMATION

LIFTING VEHICLE ON A LIFTING PLATFORM

Before driving a car on the platform, make sure that there is sufficient clearance between the lifting platform and vehicle (if applicable, spoilers or splash guards, etc.).

Lifting platforms must conform with local and national legislative measures concerning accident prevention and maintenance. Arms of a lifting platform must always be applied only on the reinforced points of the frame members.

Ensure that undercoating is not damaged.

Front

Apply rubber block of lifting arm on the front perpendicular reinforcement of the frame member, which is also provided for application of the car's jack.

Note embossed arrows on M 3 cars.

Rear

Apply rubber block of lifting arm on the rear perpendicular reinforcement of the frame member, which is also provided for application of the car's jack.

Ensure that bottom of fuel tank is not damaged.

Note embossed arrows on M 3 cars.

LIFTING VEHICLE ON A WORKSHOP TROLLEY JACK

A workshop trolley jack may also be only applied for lifting the vehicle on the same take-up points described for the lifting platform.

A suitable liner (rubber, wood or glass) must be used between the jack and vehicle to avoid damaging the undercoating, frame members or floor plate.



Front Take-up Point



Rear Take-up Point

Towing

Please respect any parking legislation concerning the towing of vehicles.

Caution!
Follow instructions in the relevant Owner's Manual.



Front towing eye



Rear towing eye

BMW MAINTENANCE SYSTEM	General Information					Important Information
	Repair Manual	Technical Data	Service Information	Operating Fluids	Owner's Manual	
00 50 000 Pre-delivery inspection Interrogate fault memories in diagnosing systems. Brief test. Check / correct engine oil level. Check fuel pipes, tank and hoses for correct routing, condition and leaks. Check connections and pipes of brake system for leaks, correct position and damage. Check / adjust parking brake lever travel. Check wheel bolt tightening torque. Check rim size, tire size and type as well as tire inflation pressure (including spare wheel).	Gr. 34	Gr. 34 Gr. 35	Gr. 35	Gr. 11	+	Refer to operating instructions for BMW diagnosing system. Connect BMW service tester. Further instructions appear on monitor. Approved oil only! Visual inspection.

BMW MAINTENANCE SYSTEM

General Information

00 00 000 Pre-delivery inspection

Check function of windshield wiper/washer and aiming of water spray nozzles; remove protective sleeves from wiper blades.

Check acid level and charged condition of battery under rear seat or in trunk and add distilled water if necessary. Change battery if necessary.

Check lights: headlights/additional headlights, parking lights, brake lights, turn signals, tail lights, backup lights, rear fog lights, license plate lights, passenger compartment lights, glowdown light, engine compartment light and trunk light.

Check horn, headlight flasher and hazard warning lights.

Check instruments and sign lights.

Check control and warning lamps in instrument cluster and check control (incl. ABS, airbag).

Check heating, ventilating and blower.

Check function of headlight cleaners and central lock.

Insert and check function of cigar lighter.

Repair
ManualTechnical
DataService
InformationOperating
ProceduresOwner's
Manual

Important Information

Gr. 00

Gr. 00

BMW MAINTENANCE SYSTEM	General Information					Important Information
	Repair Manual	Technical Data	Service Information	Operating Fluids	Owner's Manual	
00 00 000 Pre-delivery inspection Check function of other special equipment. Initiate sender of remote control system. Check data plate, vehicle identification number and engine number. Compare ordered car equipment against delivered car equipment. Tune in radio station and check for interference with engine running by switching electric equipment on and off. Mount hub caps, if applicable wheel rings and tailpipe extension. Place tools in toolbox and secure jack and wheel bolt wrench. Paste BMW emergency service label on lid of toolbox. Place owner's manual/service booklet, list of BMW service centers and BMW emergency service points, spare key and key holder in glovebox. Stamp and make entries in service booklet.						

BMW MAINTENANCE SYSTEM	General Information					Important Information!
	Repair Manual	Technical Data	Service Information	Operating fluids	Owner's Manual	
00 00 000 Pre-delivery inspection Check function of engine, clutch, transmission, final drive, steering, foot and hand operated brakes. In cars with rear disk brakes: brake in parking brake. In cars with ABS (ASC) check function of control lamps. Check function of speedometer with odometer and daily trip recorder, tachometer (economy control), clock, temperature gage and fuel gage. Check engine, transmission, steering, final drive, drive shaft boots, fuel system, clutch and brakes for leaks. Remove seal and other protective covers. <i>Important!</i> Reset service indicator only in cars up to production date of 9/90.						

BMW Maintenance System

General Information

00 00 210 BMW break-in period inspection (at 3000 km)

Repair Manual

Technical Data

Service Info

Consumables

Owner's Manual

Important Information

Caution! The break-in period inspection is not required for cars with M55 engine.

Interrogate fault memory in (Diagnose) system

Brake test

See Operating Manual
BMW Service Test

Change engine oil and oil filter with engine at operating temperature

Gr 11

Gr 11

+

Use approved oils only
Caution!
Build up oil pressure with
engine running at idle

Check valve play and adjust if necessary
(only M50, M55 and M58 engines)

Gr 11

Gr 11

Change oil in manual transmission at operating temperature
(only M35 and M36)

Gr 23

Gr 23

+

Always use approved
grades of oil

Change oil in rear axle differential at operating temperature
Caution!
On rear axle differential with track, chromated identification plate
and letter "B" on top, perform oil change at 1st engine oil service

Gr 33

Gr 33

Gr 33

Note Service Information
for special oil grade

Change oil in transfer box and front axle differential at operating
temperature (220 °C/heating)

Gr 27.21

Gr 27.21

Always use approved
grades of oil

Final inspection with check for road safety, brakes and steering,
indicator and hazard warning lights as well as Check Control
messages

+

BMW MAINTENANCE SYSTEM	General information					Important Information
	Repair Manual	Technical Data	Service Information	Operating Pages	Owner's Manual	
Interrogate fault memories in diagnosing system.						Refer to operating instructions of BMW diagnosing system.
Brake test.						Refer to operating instructions of BMW service tester.
Replace engine oil and oil filter at operating temperature.	Gr 11	Gr 11		Gr 11	+	Use approved oil. <i>Important!</i> Only build up oil pressure with engine idling.
Check, adjust valve clearance (M20, M21, M50 and S38 engines).	Gr 11	Gr 11				
Replace spark plugs (not for M40, M50 and M60 engines).		Gr 12				
Check coolant hoses for leaks, check correct coolant level and antifreeze concentration.				Gr 12	+	Replace coolant at least every 3 years.
Check tension and condition of all drive belts, tightening if necessary (not M50, M51 and M60 engines). If necessary replace and invoice separately.	Gr 12/32/54					
Drain water trap of fuel filter (M21 and M51 engines).	Gr 13					
Check routing and condition of fuel pipes, tank and hoses as well as for leaks.	Gr 13/16					
Check condition, routing and suspension of exhaust system as well as for leaks.						

BMW Maintenance System	General Information					Imported Information
	Repair Manual	Technical Data	Service Info	Consumables	Owner's Manual	
00-00 330 BMW Inspection I				Or 30		
Check power steering/level control for leaks and correct oil level (topping up if necessary)						
Ensure that steering is free of play. Inspect tie rods and front axle joints. Inspect steering unit, steering transmission, linkages, flexibles coupling and sleeves						
Check all gear units for leaks.						Visual inspection
Check oil level in manual transmission and top up if necessary (unit with M21 engine)	Or 20			Or 20		Use approved oil only
Before fitting and installing front and rear disk brake: in logs, checking overall thickness. Replace linings when necessary. Check surface condition of brake disks. Check brake caliper (disc) covers for leaks. Ensure wheel centering on disk wheels.	Or 34-36					Wheels: Check tightening torque
Check connectors and leaks on brake system for leaks (and also check for damage) and correct position. Check that handbrake cable moves freely	Or 34					Caution! Use approved brake fluid. Change approved grade of brake fluid in accordance with specified Service Interval display or clock symbol (but not later than every 3 years. See 50 Or 60)
Check: adjust handbrake lever travel.	Or 34					
Check: top up fluid level in expansion tank for brake and clutch hydraulic systems				Or 34		
Check: correct tire pressure (including spare tire). Check tire condition. If wear pattern is uneven, an optional alignment check can be carried out together with wheel alignment (this is a separate invoice item).	Or 30	Or 36	Or 34			Measure depth of tread

BMW MAINTENANCE SYSTEM

00 00 230 BMW Inspection I

General Information

	Repair Manual	Technical Data	Service Information	Operating Policy	Owner's Manual	Important Information
<p>Check function of parking lights, turn signals, side lights, brake lights, backup lights, rear fog lights, license plate lights, side-impact compartments lights, glowplug light, engine compartment light and trunk light</p> <p>Check function of headlights and additional headlights</p> <p>Check horn, headlight washer and hazard warning lights</p> <p>Check instrument and sign lights</p> <p>Check acid level in battery and add distilled water if necessary</p> <p>Check charged condition of battery (high current test)</p> <p>Replace incubation for heater or heater air conditioner (Shorten replacement intervals if car is operated in extremely dusty regions)</p> <p>Check condition and function of seat belts</p> <p>Lubricate locks of doors, engine hood and trunk lid with oil or grease and check function. Lubricate all hinges with oil or grease</p> <p>Check - correct level and antifreeze concentration of washing fluid in supply tank for windshields and headlights. Check correct antifreeze cleaning fluid level in tank if applicable</p> <p>Check windshield wiper/washer - wiper blades and timing of water spray nozzles</p> <p>Inspect entire body - not cavities - for rust damage. Repair and treat as separately under inspection and repairs in Service Booklet</p>	<p>Gr 51</p> <p>Gr 54</p> <p>Gr 72</p>		<p>Gr 66</p> <p>Gr 64</p>		<p>•</p> <p>•</p> <p>•</p> <p>•</p> <p>•</p> <p>•</p> <p>•</p>	<p>Check data plate in glove box and Service Booklet</p> <p>Models since 1990 At least after 2 years</p>

BMW MAINTENANCE SYSTEM

General information

00 00 320 - BMW Inspection I

Repair
ManualTechnical
DataService
InformationOperating
FieldsOwner's
ManualImportant information¹⁾

Final inspection with safety test (check ABS and airbag control lamps), cars with rear disk brakes, break in parking brake, check steering clutch or automatic transmission, springs and shock absorbers in quality and check function of power steering. Check control and warning lamps in instrument cluster as well as mirrors and heater blower.

Check messages in check control

Procedure²⁾

Reset service indicator after inspection!

Switch off all electrical equipment.

Switch on ignition - do not run engine.

Plug (S-R) with adapter in diagnostic socket.

Push in and hold depressed, red INSPECTION button - green lamp (function control) comes on.

Red lamp also comes on after approx. 3 seconds and goes out after approx. 13 seconds.

Release inspection button - green lamp goes out.

The time-dependent inspection interval is due when the clock symbol lights up together with the INSPECTION sign and has no influence on the green light emitting diodes. If the load and time-dependent inspections occur simultaneously, resetting must be repeated after 10 seconds to have the clock symbol and INSPECTION sign lights go out.

Important³⁾

When the clock symbol lights up in cars since 9/93 only the brake fluid has to be changed.

Checking Service Indicator

All five green light emitting diodes must come on. Yellow and possibly red light emitting diodes as well as INSPECTION sign light must go out.

S-R = Service indicator resistor. Order No. 62 1 100

Adapter, Order No. 62 1 140

BMW Maintenance System

General Information

50 00 730 BMW Inspection II + Inspection I + following work

Check pulley tension (only M40 engine).
Check / adjust pulley tension (only M21 engine).

Gr 11
Gr 11/13

Gr 11

Gr 11

Replace spark plugs (M40, M40 and M40 engine)

Gr 12

Gr 12

Gr 12

Replace main fuel filter (only cars with diesel engine).
If diesel fuel is poor quality, shorten the interval between filter changes.

Gr 13

Air cleaner: Replace air filter insert, shorten intervals
accordingly for cars operated in dusty regions.

Gr 15

a

500 Motor: Replace all Vee belts

Gr 13/12/84

Gr 00

Change oil in manual transmission at operating temperature
(except in cars with M40, M40, M41 and M40 engines).

Gr 23

Gr 23

Use approved oil only

Change oil in automatic transmission at operating temperature
(not on 540i).

Gr 24

Gr 24

Use approved oil only

Change oil in transfer box and front axle differential at operating
temperature (325i/3 touring).

Gr 27 21

Gr 27 21

Use approved oil only

Change oil in rear axle differential at operating temperature

Gr 33

Gr 33

Use approved oil only

Check rubber gaskets on output shafts

Visual inspection

Check thickness of parking brake linings.
If necessary, replace - separate instruction item.

Gr 34

Gr 34

With ABS + T: Replace filter insert in inlet.

Gr 34

a

Check park heating.

Gr 34

Repair Manual	Technical Data	Service Info	Consumables	Owner's Manual	Important Information
04-01					on every 4 years
04-02					
04-03					
04-04			04-01		Use approved oil only

BMW MAINTENANCE SYSTEM

General Information

00 00 346 BMW Annual Check

Important:

No annual checks for cars since 09/90

Only replace the brake fluid when the clock symbol lights up for every 2 years of wear (750L annually).

Cars before 09/90

Replace brake fluid every 2 years (750L annually)

Replace coolant every 2 years (invoice separately)

Inspect entire body - not cavities - for rust damage, repair and invoice separately (owner inspection and repairs in Service Booklet)

Check and adjust headlights and additional headlights

Check tire condition every 2 years (invoiced separately).

In cars with additional heater: replace glow plugs annually and heat exchanger after 10 years (invoiced separately).

Invoiced separately

Inspect supporting body parts for corrosion, breaks and cracks.

Check that performed body repairs conform with BMW standard.

Steering: check steering stops, connections, steering damper and steering assistance for leaks.

Brakes: check function of brake master cylinder / brake booster and for leaks

Repair
ManualTechnical
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Manual

Important Information!

Refer to Service Information of Group 00 to reset the service indicator

Use approved brake fluid

Gr 63

Gr 33

Gr 34

BMW MAINTENANCE SYSTEM

General Information

00 00 140 BMW Annual Check

Repair
ManualTechnical
DataService
InformationOperating
FluidsOwner's
Manual

Important Information

Important

Reset service indicator for annual check (INSPECTION and Clock Symbol)

Switch off all electrical equipment

Switch on ignition - do not start engine

Plug "SI-R" with adapter** in diagnostic socket

Purge in and hold recessed red INSPECTION button - green lamp function control comes on

Red lamp also comes on after approx. 3 seconds and goes out after approx. 12 seconds

Release inspection button - green lamp goes out

Service Indicator with Clock Symbol and Red LED

The time-dependent inspection interval is due when the clock symbol lights up together with the INSPECTION sign and has no influence on the green light emitting diodes. If the load and time-dependent inspections occur simultaneously, resetting must be repeated after 10 seconds to have the clock symbol and INSPECTION sign lights go out and activate the green light emitting diodes

Checking Service Indicator

The number of green light emitting diodes does not change by resetting the time-dependent inspection service indicator. The INSPECTION sign and clock symbol lights must go out

* SI-R = Service Indicator Reseter, Order No. 62 1 100

** Adapter, Order No. 62 1 140

New SI-R = Order No. 62 1 110

BMW MAINTENANCE SYSTEM	General Information					Important Information*
	Repair Manual	Technical Data	Service Information	Operating Fluids	Owner's Manual	
00 00 140 BMW Engine Oil Service						
Replace engine oil and oil filter at operating temperature	Gr 11			Gr 11		Use approved special oil.
Important: Rear axle final drive with track (PROMETHEUS) data plate and letter "D" on it	Gr 30					
Replace oil in rear axle final drive at operating temperature only at 1st Engine Oil Service!	Gr 33		Gr 00	Gr 33		Use approved oil
Carb. with M51 engines: replace oil in rear axle final drive at 1st Engine Oil Service.	Gr 33		Gr 00	Gr 33		Use approved oil
Important: Reset service indicator after Oil Service. Switch off all electrical equipment. Switch on ignition – do not run engine. Plug (SI-R) with adapter in diagnosis socket. Push in and hold recessed, yellow OIL SERVICE button** – green lamp (function control) comes on. Yellow lamp also comes on after approx. 10 seconds and goes out after approx. 3 seconds. Release oil service button – green lamp goes out.						
Checking Service Indicator: All five green light emitting diodes must come on. Yellow and possibly red light emitting diodes as well as OIL SERVICE sign light must go out.						
* SI-R = Service Indicator resistor, Order No. 82 1 100. Adapter, Order No. 82 1 140. Mini SI-R = Service Indicator resistor, Order No. 82 1 110.						
** Caution! Resetting with the wrong button cannot be corrected. Service intervals must be made up – also refer to BMW Technical Information for Group 62.						

BMW MAINTENANCE SYSTEM

00 00 000 BMW Safety Test

Interrogate fault memories in diagnosing system

Brake Test

Steering Test

Steering gear linkage coupling connections brake oil volume and condition of power steering

Brake Test

Brake pads (remove and install wheels, remove pads, brake disks, pipes, hoses, connections, brake fluid level, parking brake cables, parking brake, break in parking brakes)

Important

Replace brake fluid every 2 years at latest

Tire and Wheel Rim Test

Condition, tire pressure, specified size, tread depth, tire wear pattern (including spare wheel)

Light Test

Headlights, fog lamps (also aiming), parking lights, tail lights, backup lights, license plate lights, instrument and sign lights control and warning lamps.

Warning Appliance Test

Horn, headlight flasher, turn signals, hazard warning lights, brake lights, tail fog lights, burglar alarm.

Windshield Wipers/Washer and Headlight Cleaners

Wiper blades, washer (windshield if applicable headlights and interior cleaning), supply tank (fluid level/tank freeze), spray secure aiming windshield, if applicable headlights.

Seat Belts

Condition and function.

Remarks

Invoice repairs and adjustments separately

General Information

Repair Manual	Technical Data	Service Information	Operating Fluids	Owner's Manual	Important Information!
					Refer to instructions of BMW diagnosing system
Gr 30			Gr 32		Refer to instructions of BMW Service Tester
Gr 34					Use approved oil only
			Gr 34		Use approved brake fluid
	Gr 36		Gr 36		
Gr 62				+	
				+	
		Gr 00	Gr 00	+	
Gr 72					

BAY MAINTENANCE SYSTEM	General Information					Important Information
	Regist. Manual	Technical Data	Service Information	Operating Fluids	Owner's Manual	
00 00 000 Exchange Reg as inspection after 1,000 km						
Replace engine oil and oil filter at operating temperature	Gr. 11			Gr. 11	+	Use approved oil, important! Only build up oil pressure with engine idling
Check coolant hoses for leaks, Check correct coolant level and antifreeze concentration				Gr. 12	+	Use long-term antifreeze and corrosion inhibitor
Check adjust valve clearance (only M30 engines)	Gr. 11	Gr. 11				
Check correct tension of all drive belts (only M30 eng test)	Gr. 12/32/54					

BMW Maintenance System – USA

General Information

00 00 000 Pre-Delivery inspection	Repair Manual	Technical Data	Service Info	Consumables	Owner's Manual	Important Information
Caution! Items other than 1993 model produced in accordance with Quality Certification!			Gr 00			see 00 00 24 00 (0580)
Interrogate fault memory in diagnosis system						See operating instructions BMW diagnosis system Connect up BMW Service Tester
Brief test.						For further instructions, refer to screen display
Check engine oil level (check tube oil for foaming), if necessary, change oil and oil filter			Gr 00	Gr 11		Use approved oil only
Check gasket on filter cover						
Check coolant hoses for leaks and routing						Visual inspection
Check mounting of hose clips						
Check correct coolant level and concentration			Gr 00	Gr 17		Long-term additive and corrosion protection agent
Check acid level of battery and top up with distilled water if necessary. Check mounting of battery terminals.						
Check spark plugs, replace or clean if required and adjust <u>ignition timing</u>	Gr 12	Gr 12				
Check mounting and tightness of fuel lines, fuel tank and cover and fuel filter. Check fuel injection system is securely mounted. Check for leaks.						Visual inspection
Check routing of exhaust system.						Visual inspection

BMW MAINTENANCE SYSTEM — USA

00 00 000 Pre-delivery inspection	General Information					Important Information!
	Repair Manual	Technical Data	Service Information	Operating Fluids	Owner's Manual	
Tighten nuts and bolts of steering gear, joint disc, tie rods and front axle. Check whether control pins are flexing.	Gr 34	Gr 32-34				Check locks and control pins.
Check power steering for leaks.						Visual check: use approved brake fluid, use spec. red torque.
Check — adjust parking brake lever travel.						
Check level of fluid in tank for brakes and clutch.		Gr 34	Gr 50	Gr 34		
Check connections and pipes for brake system for leaks, damage and correct position.						Visual inspection
Check condition of tires, tire size and type as well as tire pressure (including spare wheel).		Gr 36	Gr 36		+	
Check tightening torque of wheel bolts. Check wheel rim size and type.		Gr 36				
Check parking lights, turn signals, brake lights, high and low beam headlights, side marker lights, fog lights, backup lights, license plate lights, passenger compartment lights (also delay system), glovebox light, trunk light and engine compartment light, sun visor mirror lamp, front and rear map reading lamps.					+	
Check — adjust aiming of headlights.	Gr 53				+	
Check horn, headlight flasher and hazard warning lamps as well as control lamps.					+	
Set clock.					+	
Program on-board computer and check function of keys and remote control.						

BMW Maintenance System: USA

General Information

00 00 000 Pre-Delivery Inspection	General Information					Important Information
	Repair Manual	Technical Data	Service Info	Consumables	Owner's Manual	
Check lighting of instrument panel and side lights. Check intensity of lighting.					+	
Check control and warning lights, clock, warning-buzzer and Check-Control. Check operation of pressure, coolant temperature, indicator lights, brake lights/brake fluid level, fog lamps, Lambda probe, safety belt, ignition key warning indicator, L/H beam lamps, fuel gauge, ABS and Airbag. Check-Control, gear display						
Fill tank on screen-wash unit and check anti-freeze concentration			Qr 00		+	If necessary add anti-freeze fluid
Fill tank on intensive cleaning unit.						
Check wash/wipe system and spray jet setting. Remove protective covers from upper blades.					+	
Check function of intensive cleaning unit.						
Check function of rear screen heating.						
Check function of cigarette lighter						
Check function of headlight cleaning system.					+	
Radio: check serial and tuning, adjust radio, check for suppression when engine running and switch off electrical consumers on in sequence, check function of cassette player	Qr 06					
Check function of any other optional extras: electrical window regulators, front and rear, side-slipring, sunroof (through all settings), fog lights and setting, electric radio aerial and regulator unit. Check function of other items of equipment fitted by dealer						

BMW Maintenance System - USA

General Information

00 50 009 Pre-Delivery inspection	General Information					
	Repair Manual	Technical Data	Service Info	Consumables	Owner's Manual	Important Information
Check wing mirror						
Check function of central locking system						
Check seat adjustment by hand/electrically						
Check safety belts						
Check license plate number, chassis number and engine number						
Check goods received against order items						
Fit hub caps and, where applicable, decorative wheel trim and exhaust trim						
Place tools in on-board tool kit; secure car jack and lug wrench						
Place BMW Emergency Service telephone number label and annual change of brake fluid						
Place Owner's Manual, directory of BMW service stations, spare key and key wallet in glove box						
Battery and accessories warranty certificates						
If applicable, operating instructions for radio						
Factory Invoice (Mehrfach abheften)						
Cleaning kit for cassette player						

BMW MAINTENANCE SYSTEM — USA

00 00 000 Pre-delivery inspection

General Information

Repair
Manual

Technical
Data

Service
Information

Operating
Procedures

Owner's
Manual

Important Information

Check acceleration, coasting and brakes (before and during road test).

Check idling speed (rpm).

Check function of mirrors.

Check for tire rattling and grinding noise.

Check driving behavior and wheel balance.

Check function of engine, clutch, transmission, final drive, steering (wheels pointing straight ahead), cars with rear brake disc, break in parking brake.

Check heating, ventilating and air conditioning.

Check function of instruments.

Check function of cruise control.

Or 34

Caution
Stronger braking effect
from systems with Padow
brake pads.

BMW MAINTENANCE SYSTEM — USA

General Information

00 00 000 Pre-delivery inspection	Repair Manual	Technical Data	Service Information	Operating Procedures	Owner's Manual	Important Information*
<p>After Road Test</p> <p>Check engine, transmission, steering, final drive, boots on drive shafts, fuel system, clutch, brakes and cooling system for leaks.</p> <p>Inspect and clean passenger compartment.</p> <p>Car washed and polished. Underbody without damage. Car without scratches or damage.</p> <p>Remove protective covers from seats and inside of car.</p> <p>Important: Always reset the service interval indicator after the pre-delivery inspection. Switch off all electric consumers. Switch on ignition. Do not run engine. Use ST-M with adapter and plug in diagnostic socket. Push in and hold momentary, red INSPECTION button – green lamp (function control) lights up. Red lamp also lights up after about 3 seconds and goes out after about 13 seconds. Release INSPECTION button – green lamp goes out.</p> <p>Checking Service Interval Indicator All five green diode lights must light up. Yellow and possibly red diode lights as well as INSPECTION sign should go out.</p>						<p>Visual inspection</p> <p>Visual inspection</p>

* BMW = Service Indicator Reseter, Order No. 62 1 900
Adapter, Order No. 62 1 140

BMW Maintenance System - USA

General Information

00-00-215 BMW Pre-delivery inspection at 1700 miles	Repair Manual	Technical Data	Service Info	Consumables	Owner's Manual	Important Information
<p>Caution! From 1993 model, proceed in accordance with Quality Certification II.</p> <p>Interrogate fault memory in diagnostic system:</p> <p>_____</p>			Gr 10			See 51-00-34 00 (3880)
Replace oil and oil filter with engine warm.	Gr 11		Gr 10	Gr 11		Use approved oil only
Check / adjust valve clearance (only M20 and M30 engines)	Gr 11	Gr 11				
Change oil in manual transmission at operating temperature (except for 121e).	Gr 23		Gr 10-23			Use approved oil only
Change oil in rear axle differential at operating temperature		Gr 10	Gr 10	Gr 10		Use approved oil only

BMW Maintenance System (BMA)

General Information

00 00 320 BMW Inspection I	Repair Manual	Technical Data	Service Info	Consumables	Owner's Manual	Important Information
Interrogate fault memory in diagnostic system.						Refer to operating instructions BMW Diagnostic System. Consulting BMW Service Technician. For additional information, refer to section 000000.
Brief test						
Replace oil and oil filter with engine warm	Gr. 11		Gr. 00	Gr. 11	-	Use only approved grades of oil.
Check/adjust valve clearance (only M20, M30 and S30 engines)	Gr. 11	Gr. 11				
Clean joints and bearing points on throttle cable actuating mechanism and oil and grease.						Use Molykote Longterm. BMW Order No. 01 22 9 401 007
Check fuel tank, cover, pipes and connections for leaks						Visual inspection.
Check cooling system and all connected parts and fitting hoses for leaks, check coolant level and concentration and top up if necessary						Caution! Coolant must be fully drained and changed every 2 years (from date of manufacture)
Change every 2 years						
Check condition, routing, mounting and tightness of exhaust and	Gr. 10					
Check oil level in manual transmission and top up if necessary		Gr. 23	Gr. 00	Gr. 23		Use approved oil only.
Check all transmissions for leaks						Visual inspection.
Check power steering for leaks and check/correct fluid level	Gr. 20		Gr. 00	Gr. 20		
Check condition of wheel suspension, track rods, front axle joints, dampers and flexible coupling	Gr. 21 Gr. 26					Use correct tightening. Visual inspection of outer pins, bushes etc.
Check steering for clearance in straight-ahead setting.	Gr. 20					

80 00 220 BMW Inspection I	Repair Manual	Technical Data	Service Info	Consumables	Owner's Manual	Important Information
Check/correct oil level in rear axle differential			Gr 00	Gr 33		Use approved grades of oil only
Remove! Install front and rear disk brake linings. Check total thickness. Replace linings when necessary. Check brake disk surface condition.	Gr 34	Gr 34	Gr 36			
Lubricate wheel hubs.						
Check/correct fluid level in expansion tank for brake and clutch hydraulic fluid	Gr 34		Gr 00	Gr 38		Use approved brake fluid only
Change! Change brake fluid every 2 years at the latest.						
Check brake calipers and dust covers for leaks.	Gr 34					Visual inspection
Check brake connections and pipes for leaks, damage and correct location.	Gr 34					
Check parking brake cable for ease of movement. Adjust parking brake.						
Check tire pressure (including spare wheel). Check trunk for fuel vapor (buses).			Gr 36			
Check condition of tires.						
Unwin the wheel (recommended alignment check using computer testset, to be involved separately).	Gr 32					

50 50 529 BMW Inspection I

Repair Manual

Technical Data

Service Info

Consumables

Owner's Manual

Important Information

Level control system: check hydrau. v. fluid level in laden vehicle. If necessary top up hydraulic fluid (not required from 50 model onwards)

Gr 37

Gr 37

Tighten locks on doors, hood and trunk lids, oil, grease and perform a function check
Oil or grease at hinges

Check electrolyte level in battery, top up with distilled water if
[]

Function check air-conditioning system and flow of refrigerant.

Gr 54

Replace microfilters in air-conditioning unit.
Shorten interval accordingly for cars operated in dusty regions.

Gr 54

Check function of following equipment:

Lighting system: headlights, parking lights, reversing lights, license plate light, interior light with delay system, glove box light, engine compartment and trunk lighting.

Gr 53

Warning equipment: indicator lights, hazard warning lights, brake lights horn, headlight flash and dip switches.
Check correct beam alignment of headlights.

Check function of Check-Control: control lamps for ABS and Airbag

00 00 000 BMW Inspection I	Repair Manual	Technical Data	Service Info	Consumables	Order a Part call	Important Information
<p>Top up supply tank for windshield wash unit/check windshield concentration. If necessary, top up fluid for intensive cleaning.</p> <p>Check function of windshield unit and check setting of spray jets.</p> <p>Check condition and operation of seat belts.</p> <p>Final inspection and test run with inspection of opening safety: Brakes, steering, clutch, automatic transmission and mirrors, Break in parking brake.</p> <p>Check all installations for leaks.</p> <p>Caution! After inspection I, reset Service Interval Indicator. Switch off all electrical equipment. Switch on ignition. Do not run engine. Use SI-R* with adapter and plug in diagnostic socket. Push in and hold down the red INSPECTION button: green lamp (function check) lights up. Red lamp also lights up after about 3 seconds and goes back out after about 12 seconds. Release inspection button - green lamp goes out.</p> <p>Checking service indicator: All five green diode lights must light up. Yellow and possibly red diode lights as well as INSPECTION sign should go out.</p>	Or 34			Or 00		<p>Caution! Press-assisted braking system of units fitted with Proton brake lining: Break in parking brake see 34 10 014 in the repair manual. Visual inspection.</p>

* **SI-R** = Service Indicator Reseter Order No. 82 1 100
Adapter Order No. 82 1 140

see SI-R/Service Indicator Reseter Order No. 82 1 110

BMW Maintenance System - USA

General Information

00 00 31 BMW Inspection II + Inspection I + following supplementary procedures

Check tension and condition of all V-belts and tighten if necessary (except M50, M50 engines). If necessary, replace and adjust separately.

Replace all V-belts on M50 engines and injectors separately.

Replace spark plugs

Air cleaner: Replace air filter insert.
Shorten interval accordingly for cars operated in dusty regions.

Replace fuel filter
If dirty fuel is used, shorten interval accordingly (recommended in California, mandatory in all other States).

Check clutch drive disk for wear

Change oil in manual transmission at operating temperature (only M50, M5)

Change oil in automatic transmission at operating temperature

Perform oil change on rear axle differentials at operating temperature

Check condition on ball joints on output shafts

Rear disc brakes: Check thickness of parking brake linings

ABC +7: Replace filter insert in fuel

Repair Manual

Technical Data

Service Info

Consumables

Owner's Manual

Important Information

Gr 12/22/24

Gr 12

Gr 12

+

Gr 12

Gr 18

+

Gr 21

Gr 23

Gr 30

Gr 21

Use approved oils only

Gr 24

Gr 24

Gr 30

Gr 24

Use approved oils only

Gr 32

Gr 30

Gr 32

Use approved grades of oil only

Gr 34

Gr 34

BMW Maintenance System - USA

General Information

50 00 00's BMW Inspection II - Inspection II - following supplementary procedures	Repair Manual	Technical Data	Service Info	Consumables	Owner's Manual	Important Information
Every 2nd inspection II						
Replace tested belt (no later than every 50 000 miles). Invoice as separate item	Gr 11					
Change oil in manual transmission at operating temperature (only 524i T)		Gr 31	Gr 55	Gr 23		Use approved oils only
Check entire body for rust damage in accordance with warranty terms (at least once every two years).						
Caution! Reset Service Interval Indicator after inspection II. Switch off all electrical equipment. Switch on ignition. Do not run engine. Use 50iR with adapter and plug in diagnosis socket. Press and hold down red INSPECTION button: green lamp (function check) lights up. In addition, the red lamp lights up after about 3 seconds and goes back out after about 12 seconds. Release inspection button - green lamp goes out.						
Checking service indicator All five green check lights must light up. Yellow and possibly red check lights as well as INSPECTION sign should go out.						
* 50iR - Service Indicator Resetter - Order No. 02 1 1 00 Adapter - Order No. 02 1 1 40						
new 50-R - Service Indicator - Resetter - Order No. 02 1 1 10						

BMW Maintenance System - USA

General Information

00 00 140 BMW Annual inspection (at 11-12 month intervals)

Repair Manual

Technical Data

Service Info

Consumables

Owner's Manual

Important Information

Caution!
Change brake fluid every 2 years at the latest

Gr 34

Gr 00

Gr 34

Use approved brake
fluid

Check master cylinder and servo for correct operation
(function check) and leaks. Check correct beam settings
of headlights and fog lamps.
Check steering angle of lock, screw connections, servo
assistance.

Caution!
Completely drain coolant every two years (from date of first
registration) and check anti-freeze (service separately).

Gr 00

Gr -17

Use approved anti-freeze

Check body for damage, refer to BMW 6 year warranty
against rust damage

+

Record inspections and/or
repairs made in the operating
manual

BMW MAINTENANCE SYSTEM USA

00 00 240 BMW Engine Oil Service

General Information

Repair Manual	Technical Data	Service Information	Operating Fluids	Owner's Manual	Important Information*
<p>Replace engine oil and oil filter at operating temperature</p> <p>Reset the service interval indicator after Oil Service</p> <p>Switch off all electric consumers</p> <p>Switch on ignition</p> <p>Do not run engine</p> <p>Use G4-R* with adapter and plug in diagnostic socket</p> <p>Push in and hold yellow OIL SERVICE*** button - green lamp (function control) lights up</p> <p>Yellow lamp also lights up after about 10 seconds and goes out after about 3 seconds</p> <p>Release OIL SERVICE button - green lamp goes out</p> <p>Checking Service Interval Indicator After About 10 Seconds</p> <p>All five green diode lights must light up</p> <p>Yellow and possibly red diode lights as well as OIL SERVICE sign should go out</p> <p>Important!</p> <p>Do not reset the service interval indicator if the oil is changed additionally (between normal intervals) on request of the customer</p> <p>*** Caution!</p> <p>Resetting with the wrong button cannot be corrected</p> <p>Service intervals would be increased up - also refer to BMW Technical Bulletin of Group 62 for information.</p> <p>* G4-R = Service Indicator Reseter, Order No. 62 1 140 Adapter, Order No. 62 1 140</p> <p>New Service Indicator Reseter Order No. 62 1 140</p>					
		Gr 00	Gr 11		Use approved oil only

BMW MAINTENANCE SYSTEM — USA

65-00 350 Extra Recommended Service Involved Separately

Steering Test
Steering gear linkage, coupling connections, leaks, oil volume and condition of power steering

Gr 32

Brake Test
Brake pads (rimmed and inner) wheels), brake discs, pipes, hoses, connections, brake fluid level (parking brake important)
Replace brake fluid every 3 years at latest (beginning from date of manufacture).

Gr 34

Tire and Wheel Rim Test
Condition, tire pressure, specified size (including spare wheel)

Gr 36

Light Test
Headlights (fog lamps (also driving), parking lights, tail lights, backup lights, license plate lights, instrument panel lights, glove box light, engine compartment light, trunk light, control and warning lamps, Check, Control, ABS and airbag warning lamp)

Gr 60

Warning Appliance Test
Horn, headlight flasher, turn signals, hazard warning lights, stop lights

Windshield Wipers/Washer and Headlight Cleaners
Wiper blades, wiper (wind shield), if applicable headlighters and extensive cleanings, supply tank (fluid level and pressure), spray nozzle (cleaning), if applicable headlighters, if applicable level of intensive cleaning fluid

Gr 00

Gr 00

Safety Belts
Condition and function

Gr 72

Clean cassette player head and align rollers every 50 to 100 hours or more often in case of poor sound quality

Final inspection and road test with traffic safety checks
Brakes, steering, clutch or automatic transmission and mirrors

Remarks
Invoiced repairs and adjustments separately

General Information

Repair
ManualTechnical
DataService
InformationOperating
FluidsOwner's
Manual

Important Information*

Use approved oil only

Use approved brake
fluid onlyCaution
Stronger braking from
systems with Polaris
brake pads

BMW Maintenance System

General Information

BMW Lambda oxygen sensor service

Repair Manual

Technical Data

Service Info

Consumables

Owner's Manual

Important Information

Please remember!

Replace Lambda sensor every 50 000 miles

Every 3 years, from date of manufacture

BMW Airbag system (SRS) inspection

Visual inspection to ensure that:

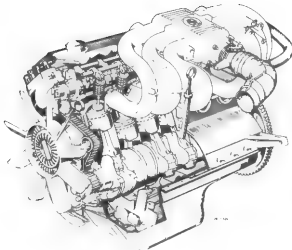
All airbag (SRS) components are still in original condition (no change in shape or location).

No unauthorized wiring changes, no additional cables or connections on airbag cable harness. The airbag trim and supports are not cut, torn or damaged in any way. The airbag must never be tested with cleaning, abrasive or protective agents. Ensure that the correct labels are pasted to (1) the front axle beam and glove box

11 Engine M20

11 00 039	Compression – check	11- 00/2 2
11 00 060	Engine – remove and install	11- 00/2 2
11 11 160	Bearing for oil pump drive shaft – replace	11- 11/2 1
11 12 000	Cylinder head cover – remove and install	11- 12/2 1
11 12 100	Cylinder head – remove and install	11- 12/2 1
11 31 110	Timing belt – replace	11- 31/2 1
11 40 000	Engine oil pressure – check	11- 40/2 1
11 78	Oxygen sensor – check	11- 78/2 1

For further jobs refer to "Assembly Repair Manual"



BMW 520i M 20 B 20 M
BMW 525i M 25 B 25 M

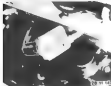
M 20
B
20
M

- Small 6 cylinder
- Gasoline
- Displacement x 100
- Motorcode

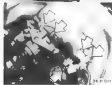
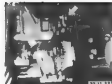


11 00 035 CHECKING COMPRESSION

Take off cover on electric box in engine compartment at right rear.
Pull off starter relay (2).



Unscrew all spark plugs.
Press down on accelerator pedal and operate starter until gross air stops + stop.
Specifications: 10 to 17 bar (140 to 150 psi), 7 max. deviation between cylinders + 0.5 bar (0.7 psi).
Average.
Tightening torque for spark plugs = 20 Nm (15 ft. lbs.).



11 00 050 REMOVING AND INSTALLING ENGINE

Remove transmission - see G- 23/24

Disconnect battery

Cars with Power Steering

Unscrew power steering pump hoses remain connected.

Cars with Air Conditioning

Isolate compressor (refrigerant pipes remain connected)

See addendum

Check tightness of drive belt with Special Tool 11 5-030

Unscrew plug and drain coolant

Remove radiator - see 11 11 030

Remove belt - see 11 52 000

Disconnect cables and vibration holders



Lansen clamp (1)
Disconnect hose in order on an alternator
Release and remove
Open straps (2) and pull off plug (3)



Lansen clamp: 1) and pull off hose
Loosen nuts (2) and remove a cleaner



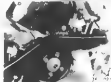
Disconnect radiator hose (1) and fuel hoses (2 and 3)
Caution!
Don't mix up hoses (2 and 3)



Pull off plug on idle speed control
Cut off work strap and pull off vacuum hose
No longer needed



Disconnect heater hoses (1 and 2) and pull off vacuum hose (3)



Unscrew coolant pump



Pull off ignition leads on ignition coil
Pull off plug (1) on air pressure on 1/4
Lift out electric lead from underneath distributor and place leads aside to the left of the engine
If applicable, disconnect pipes (2) for oil



Disconnect connecting rod/bleed starter
Take off cover (1) and disconnect connecting lead on alternator
Disconnect plug (2)

11-00/2.4



Pull off plugs (1) and (2)

00000

Plug 1 = reference mark sender

Plug 2 = cylinder identifying sender



Attach Special Tool 11 0 020 on front and rear ends of engine and take out engine



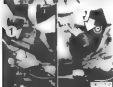
Pull off hose (1) and plug (2) and (3)

Disconnect plug (4)



Remove nuts and place engine wire

00000



Remove ground strap (1)

Remove engine mounts (left from above, right from below)

00000

Attachment

Secure gaspiston with tape on axle carrier

Tightening torque for engine mounts =

45 Nm (33 S ft. lbs.)

11-11/2.1



11 11 160 REPLACING BEARING FOR OIL PUMP DRIVE SHAFT

Remove oil pump see 11 41 300
Unscrew bolt (1) and lift off cover (2)



Remove gear wheel (3)
Oil pump
Open end of gear wheel shaft (see above)
Check see (5) replacing if necessary



Drive out needle bearing from bottom to
top with Special Tool 11 1 212.



Installation
Lubricate needle bearing with grease
Drive in needle bearing against stop with
Special Tool 11 1 300

11-12/2.1



11 12 500 REMOVING AND INSTALLING CYLINDER HEAD COVER

Take off support and venting hose

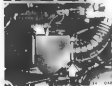
Unscrew nuts (1 - 8) and take off cover

Installation:

Check gasket - replacing if necessary

Tighten nuts in order of 1 through 8

Tightening torque = 9 Nm (6.5 ft. lbs.)



11 12 100 REMOVING AND INSTALLING CYLINDER HEAD

Disconnect battery - see Gr. 99

Unscrew exhaust pipes on exhaust manifolds and loosen clamp of holder on transmission

Installation:

Replace gaskets and self locking nuts

Coat studs with copper paste**

Tightening torque = 60 Nm (38 ft. lbs.)

Over-tighten on stages and radiator

Draw engine on

Installation:

Fill and bleed cooling system - see Group 17

Disconnect cables and unscrew holder

Loosen hose clamp and pull off intake air

hose on air cleaner

Pull off plug on air flow sensor

** Source of Supply: HMM

11-12/2.2



Pull off plug on idle speed control.
Cut off wire ring and pull off vacuum hose for brake booster.



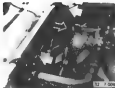
Disconnect radiator hoses (1 and 2), heater hoses (3) and fuel hoses (4 and 5) installation.
(Don't mess up fuel hoses (4 and 5))



Pull off hose (1) and plug (2 and 3).
Disconnect plug (4).



Remove inverted nut and take off plug.
Remove nuts and take wire connector plate off of intake manifold.



Remove fan. [see 11 52 000](#)
Lift out expansion rivets at left and right top on fan cover and remove fan cover.
Installation.
Check for correct seating of bottom guide.



Loosen nut and take off pressure hose.
Unscrew guide tube for oil dipstick on manifold.
Remove together drive belt. [see 11 21 110](#)
(conform with specifications in regards to replacing the toothed drive belt).



Disconnect heating hose on cyl. head head.
Remove cyl. head head cover. [see 11 12 000](#)



Press down on venting pipe and insert with Special Tool 11 1 290.
Installation.
Check seal, replacing if necessary.
Check for correct seating of venting pipe after removal of Special Tool 11 1 290.



Release cylinder head bolts working from outside to inside in sequence 14 - 1
Remove cylinder head



Inspection note

There must be no bolt in the blindholes (risk of cracking, incorrect tightening values).

Clean sealing surfaces

If 1 cylinder head gasket in position

Replace cylinder head bolts

If only tighten cylinder head bolts with special

tool 11 2 110 or 00 0 120 in the sequence

1 - 14

For tightening torque

refer to Technical Data 11 02 242

11 31 116 REPLACING TOOTHED DRIVE BELT

Important!

Always replace an used toothed drive belt with a new belt each time the tensioning roller is loosened, regardless of the number of kilometers or miles used.

Unscrew distributor cap (1) and distributor rotor (2).
Remove cover (3).
Unscrew belt (4).

Set cylinder number 1 to TDC by turning the crankshaft (arrow on camshaft sprocket faces mark on cylinder head).
Remove vibration damper (see 11 31 016).

Pull off plugs (1) and (2) on engine harness plate.
Pull off plug on oil pressure switch.

Loft out wire duct (underneath distributor) and place electric leads aside.

Take off rubber guard (1).
Unscrew nut (2) and take off cover (3).

Unscrew clamp (1).
Unscrew screw (2) and take off cover (3).

Loosen bolts (1 and 2).
Press in tensioning roller.
Tighten bolt (2).
Take off toothed drive belt.



11-31/2.2



Installation

Install toothed drive belt starting on the crankshaft sprocket and continuing in upper to direction of engine's rotating direction.

Toothed Drive Belt Layout

- 1 Camshaft sprocket
- 2 Tensioning roller
- 3 Crankshaft sprocket
- 4 Intermediate shaft sprocket
- 5 Toothed drive belt



Tightening Toothed Drive Belt

Loosen bolt (2). It should be possible to move the tensioning roller with spring force.

Crank engine once in running direction up to the TDC mark (toothed drive belt tightens itself).

Check timing (mark on camshaft sprocket must be precisely aligned with mark on cylinder head when crankshaft is in TDC position).

- Mount tensioning roller (tighten bolt 2 first and then bolt 1).

Insert label with date and mileage on cylinder head cover after timing setup.

11-40/2.1



11-40-000 CHECKING ENGINE OIL PRESSURE

Remove splash guard

Pull off plug on oil pressure switch (under right engine cover) and remove oil pressure switch

Apply Special Tool 11-4-000 with a seal and connect on BMW Service Tester

Check oil pressure

At idle speed 0.5 to 2 bar (7 to 28 psi)

Max. pressure 4 to 6 bar (57 to 86 psi)

Oil/pressure

Tightening torque for oil pressure switch

= 25 Nm (25 ft. lbs.)



32 11 1

11-78 CHECKING OXYGEN SENSOR

A Check Heating

- Disconnect plug for oxygen sensor
- Connect ohmmeter on jacks 3 and 4
- Read ohm resistance and measure
- resistance (normal value < 5 ohm)
- 1 = Plug for sensor voltage -
- 2 = Plug for sensor voltage +
- 3 = Jack for sensor heating
- 4 = Jack for sensor heating

B Check Signal Voltage

- Perform "Oxygen Sensor Voltage"
- status test in scope of DME self diagnosis
- Value is measured at idle speed with
- connected oxygen sensor and switched
- on oxygen sensor control (about 1 to 2
- minutes after starting the engine) and
- should be between 0.02 and 0.85 V
- If a constant voltage of 0.45 V is measur-
- ed, the oxygen sensor is not working
- (oxygen sensor or power supply lead
- faulty)

11 Engine M21

	Notes	11- 00/1 1
11 00 038	Compression – check	11- 00/1 2
050	Engine – remove and install	11- 00/1 3
11 11 160	Bearing for oil pump drive shaft – replace	11- 11/1 1
11 12 000	Cylinder head cover – remove and install	11- 12/1 1
100	Cylinder head – remove and install	11- 12/1 1
11 13 000	Oil pan – remove and install	11- 13/1 1
11 65 015	Exhaust turbocharger – check bearing play	11- 65/1 1
018	Exhaust turbocharger – check boost pressure	11- 65/1 1
020	Exhaust turbocharger – remove and install	11- 65/1 2
059	Control valve – check and adjust	11- 65/1 3
060	Control valve – remove and install	.. , 11- 65/1 3
	Boost pressure sensor – check	11- 65/1 4
11 66 000	Vacuum pump – remove and install/check	11- 66/1 1

For further jobs refer to "Assembly Repair Manual"

M 21

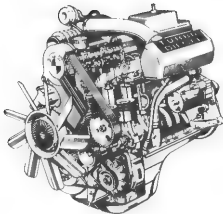
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24

■

A

- Small 8 cylinder
- Diesel
- Displacement x 100
- Fuel chamber
- Supercharging



M21 11 181

WORKING INSTRUCTIONS**a. Reference to Cleanliness of Fuel System**

Clean and inspect open ports thoroughly (for example, before loosening pipes, hose switches, etc.)

Place removed parts on clean surface only and cover with plastic sheet (never use plastic bag liner).

b. Cover or install plugs in open ends of pipes/hoses or openings in components.

Only reuse cleaned parts.

Take new parts out of their packaging only immediately before installation.

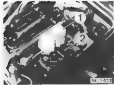
Keep diesel fuel off of coolant hoses. Rins off with water immediately if necessary.

11 00 039 Check ng compression

Measuring conditions
Battery in perfect working order: check acid density if necessary
Max. constant temperature 35 °C



Note
Special tool 11 0 180 can be re-used



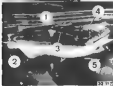
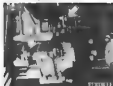
Open cover of Cylinder
Disconnect main relay (1) and plug connector (2) from glow plug timer



Remove glow plugs with special tool 12 2 100
Insert/Glaze mode
Thorough coat thread of glow plugs with copper paste "CRC" (see BMW Parts Service) for tightening torque refer to Technical Data 12 20 1 AE/242



Fully screw in special tool 11 0 222 and tightly tighten by hand
Compression tester Pn special tool 11 0 221 operate starter until pressure no longer increases
For compression pressure, refer to Technical Data
All cylinders approx. same value



11 00 050 REMOVING AND INSTALLING ENGINE

Disconnect battery

Remove transmission - see 01 22 or 24

Unscrew power steering pump (hoses remain connected)

Installation

Check drive belt tightness with Special Tool

11 5 029.

Cars with Air Conditioning

Unscrew compressor (refrigerant hoses remain connected)

Installation

Check drive belt tightness with Special Tool

11 5 029.

Unscrew plug and drain coolant

Remove red cover - see 12 11 000

Pull off plug (1)

Unscrew nuts (2) on left and right sides

Disconnect hoses (3 - 5) and remove coolant expansion tank



Disconnect heater hoses

Cars with Automatic Transmission

Disconnect air pipes on engine

Loosen hose clamps (1 and 2) and pull off hoses

Unscrew nut and remove air cleaner

Loosen clamp and pull hose (1) off of

column head cover

Pull off vacuum hose (2)

Unscrew belt (1) and take off all pipes lying

across pipes and openings in crankcase

Unscrew nuts (2), take on filter housing off

of body and suspend from engine on a piece

of wire

Installation

Check O-rings, replacing if necessary

Tightening torque for belt (1) = 22 Nm

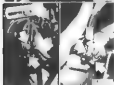
(18 ft. lbs.)



Disconnect fuel pipes (1 and 2)
Unscrew nut (3) and take off electric feed
Pull off vacuum hose (4)
Install new
Check seals, replacing if necessary.
Bleed fuel system - see 13-01, 320



Pull off plug (1) on charge air temperature sensor
Loosen clamp (2)



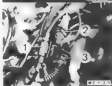
Disconnect connecting leads on sensor and alternator



Cut through connecting lead for c- pressure switch
Install new
Solder ends of lead together or install a plug connector



Disconnect plug (1) for injection pump
Get with Automatic Transmission
Push down holder (2)



Disconnect plugs (1 and 2)
If applicable, separate rear connections for in-spool switch



Loosen clamp (1)
Pull off plugs (2 and 3) on temperature sensors
Disconnect all electric leads on glow plugs
Cut off wire straps and take wire harness off of engine



Unscrew ground strap (6) and both engine mounts
Install new
Insert guide (7) into bore in sole carrier
Tightening torque for engine mounts = 45 Nm (33 ft. lbs.)

11-00/1.5



Attach Special Tool 11 0 020 on engine and
lift out engine

11-11/1.1

11 11 180 REPLACING BEARING FOR OIL PUMP DRIVE SHAFT

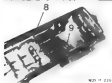
Replaced oil pump - see 11 45 000
 Remove injection pump - see 1 3 51 000
 Uncover camshaft

1. Fit seal cap (1)
 Remove gear wheel (2)
 reposition
 Open end of gear wheel shaft legs down
 Check bearing in cover (3) and seal (3)
 replacing if necessary

Drive out needle bearing from bottom to
 top with Special Tool 11 1 310

Installation
 Lubricate needle bearing with grease
 Drive in needle bearing against stop with
 Special Tool 11 1 300





11 12 000 REMOVING AND INSTALLING CYLINDER HEAD COVER

Disconnect hoses - see 11 12 000

Loosen screws of cover

Installation

Tighten cylinder head cover first and then protective cover

Unscrew oil trap (1)

Unscrew screw-in sleeve and take off oil filter head cover

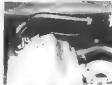
Installation

Install sleeve in sleeve with seal. Check seal on oil trap - replacing if necessary

Tightening torque = 15 Nm (11 lbf ft)

Installation

Check cylinder head cover gasket (10) and rubber ring (11) - replacing if necessary. Insert rubber ring (11) in cover and lubricate with oil



11 12 000 REMOVING AND INSTALLING CYLINDER HEAD

Disconnect battery

Drain engine oil

Drain coolant at engine block and radiator

Installation

Fill and bleed cooling system - see 11 12 000

Pull off plug (1)

Unscrew nut (2) on left and right sides

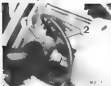
Disconnect hoses (3 - 5) and remove coolant in pressure tank

Loosen clamp and pull off vacuum hose

Remove fuel filter - see 11 12 000

Remove fan - see 11 12 000

Disconnect coolant hoses on thermostat housing



Loosen hose clamp and pull off coolant hose (1).
Pull off high hose (2) and disconnect on injection pump.



Pull off vacuum hose (1) and plug (2).
Loosen clamp (3).
Unscrew support (4) on manifold and transfer on engine block.



Loosen hose clamps and pull off hoses.



Pull off plugs (1 and 2) on temperature sensor.
Unscrew holders (3 and 4) on cylinder head.
Disconnect all electric leads on glow plugs.



Unscrew oil trap (13).
Pull off hose (14).
Assemble.
Check seal, replacing if necessary.



Disconnect injection pump on injection module and injection pump with Special Tool 13-5/220.
Install protective caps.
Remove cylinder head cover (see 11-12/500).
Tightening torque = 20 to 25 Nm (15 to 18 ft-lbs).
Bleed fuel system (see 13-51/320).



Turn cylinder number 1 to TDC (cylinder number 5 on top).



Hold crankshaft with Special Tool 11-2/303.
Caution!
Remove special tool before operating engine.

11-12/1.3



5 Disconnect hose (5) and unhook ground the cover

PRECAUTION

First tighten cylinder head cover screws, and then the protection cover screws.



Loosen screws (1 and 2) and (3)
Loosen timing belt and take it off of the camshaft sprocket

PRECAUTION

Install and tighten timing belt (refer to 11.21.112 in Construction Group Repair Manual)



Unscrew bolts in sequence of 14 up 1 and remove cylinder head

PRECAUTION

Keep oil out of holes (danger of clacking head, fractured tongue valve)
Clean cylinder head bolts
Give threads and head bearing surfaces of bolts a light coat of oil
Replace cylinder head gasket
Measure piston protrusion (refer to 11.12.10)



Tighten bolts in sequence of 1 to 14 in three steps
Adjust valve clearance (refer to 11.24.004)
Adjust slack adjustment of injection pump (refer to 12.21.005)
In the third step (cylinder head cover removed) again after engine run (water) tighten the cylinder head bolts regardless of the engine temperature using Special Tool 11.2.110.

* Refer to Specifications



11 13 000 REMOVING AND INSTALLING OIL PAN

Remove splash guard
Unscrew reinforcement plate



Unscrew bolt and pull out guide tube for oil dipstick from above
Loosen clamp and pull off venting hose
Replace O-ring on guide tube



Drain engine oil – see 00 11 200
Disconnect hose (1)
Care with Automatic Transmission
After unscrew oil pipes (2) on oil pan
Unscrew oil pan



Unscrew oil pump and remove oil pan
Reassembly
Install oil pump drive shaft – see 11 41 000
Replace gasket



Installation
Clean mating surfaces
Apply a coat of thread-on universal mating compound** on joints between timing case cover and end cover

11-65/1.1

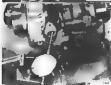


11 65 016 CHECKING BEARING PLAY OF TURBOCHARGER

Excessive bearing play could be the cause for excessive oil in the turbocharger (check oil) (be noticed by blue smoke) or noise.
Removal axial play: max. 0.18 mm (0.009")
Apply dial gage on turbocharger shaft and move shaft from stop to stop gently.

Warning

Turn turbocharger shaft and repeat step.



Removal radial play: max. 0.08 mm (0.003")
Mount dial gage on turbocharger shaft.
Move turbocharger shaft simultaneously on both sides from stop to stop and gently.

11 64 018 CHECKING CHARGE PRESSURE OF TURBOCHARGER

Checking on Dynamometer

Check with help of DDE self diagnosis (see 11 64 015).

Run car in load range

Read charge pressure (absolute) as in including atmospheric pressure from charge pressure sensor display.

Normal value: max. 1050 + 50 mbar



Checking a Road Test

Connect pressure tester 13 5 000 between intake manifold and charge pressure sensor and drive in passenger compartment.
Be careful that hose is not clamped.
Operate car in load range (braking) to check the charge pressure.

Normal Value

Measured charge pressure = atmospheric pressure (see 11 65) + max. 1050 + 50 mbar

Possible Faults for Incorrect Charge Pressure

Bypass regulator (see 11 65 054)

Charge pressure sensor (see 11 65)

Hose connections (check for leaks with soap)

Turbocharger (shaft hard to turn (bypass)



11 85 000 REMOVE RO AND INSTALLING TURBOCHARGER

The turbocharger receives oil from the engine oil circuit. Conform with the following points to guarantee sufficient lubrication for the first running turbocharger.

- Engine oil circuit in perfect condition (used oil engine oil, oil level, crankcase breather, etc.)
- Never start engine before the engine oil pressure has been built up (several turns). Any more stops engine while running at fast speed (turbocharger runs on).
- Never start engine immediately after replacing oil. Build up oil pressure first by cranking engine with the starter (disconnect feed for fuel shut-off) (see 11 00 000).
- Excessively old engine oil could produce carbon in turbocharger. Carbon will be seen on the turbocharger shaft after taking off the oil pipe. In this case the engine oil and oil filter have to be replaced.

Working On Turbocharger

Even minute particles of dirt could lead to destruction of the turbocharger, so that the engine must never be operated without the air cleaner.

If the hose on the regulating valve is disconnected, this could lead to overcharging and destruction of the engine with the throttle wide open.

No repairs are approved on the turbocharger.



Loosen hose clamps (1) and (2) and pull off hoses.
Unscrew nut and replace air cleaner.

Uncover nuts (1) and (2).

Disconnect oil pipe (3) and hose (4) on turbocharger.

Replace with testing nuts.

Coat studs with copper paste^{**)}.

Tightening Torque

Nuts (1) and (2) = 30 Nm (22 ft. lbs.) initial

and 50 Nm (36 ft. lbs.) final torque

Oil pipe (3) = 22 Nm (16 ft. lbs.)

Uncover oil pipes.

Installation

Check O ring, replacing if necessary.

Tightening Torque

Bolt (1) = 22 Nm (16 ft. lbs.)

Pipe (2) = 40 Nm (29 ft. lbs.)

Tighten bolt (3) last.

Uncover bolts and remove turbocharger.

Installation

Check flatness of sealing surface^{*)}.

Tightening torque = 25 Nm (18 ft. lbs.)

^{**) Source of Supply: Fendt}

11 65 559 CHECKING AND ADJUSTING CONTROL VALVE

The control valve governs the charge pressure.

A control valve opening too early will be noticed on a drop in engine power and an excessively rich mixture (soot in exhaust).

A bypass valve opening too late will result in excessive charge pressure.

Pull off hose (1) and connect Special Tool 11 7 610.

The control valve begins to open at a pressure of 1120 ± 30 bar (15900 \pm 427 psi) — the regulating rod of a closed control valve must bear without tension on pin (2).

Unscrew nut (2).

Take circlip off of pin (3).

Adjust opening begin of control valve as described above.

Note:

One turn of the rod is equal to 0.05 bar (0.7 psi) pressure.

Attention:

Lock nut (2) with marking gauge**

The regulating rod of a turbocharger installed standard is locked and therefore cannot be turned.

These control valves with lock regulating rods must be replaced when the begin of opening is not correct — see 11 65 560.



11 65 560 REMOVING AND INSTALLING CONTROL VALVE

Remove circlip (1) and disconnect rod

Pull off hose (2).

Unscrew bolts (3).

Installation:

Replace bolts (3).

Adjust control valve — see 11 65 559.



** Source of Supply: HWB
HWB No. 01 22 9 407 404

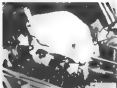
11 55 CHECKING CHARGE PRESSURE SENSOR

The charge pressure sensor is tested with OBD self-diagnosis by calling the status list.

With the engine stopped the charge pressure sensor should indicate the actual atmospheric pressure.

The following table only contains reference values. These values must be allowed a tolerance of ± 70 mbar due to fluctuations in the weather.

Height Above Sea Level in meters	Atmospheric Pressure in mbar
0	1000
500	950
1000	900
1500	850
2000	800



11 48 000 REMOVING AND INSTALLING CHECKING VACUUM PUMP

Remove cyl. valve head cover - see 11 12 000
Turn cam for vacuum pump down.
Unscrew nuts and take off vacuum pump.



Precautions

Mount vacuum pump that pipe adapter is at rear and cam hits in opening of plunger (insert see #12)

Caution!

Never run engine without the vacuum pump
loose cam ring



Checking Vacuum Pump Pressure and Orifice

Connect BMW SERVICE TESTER on the
orifice and measure vacuum with the engine
running

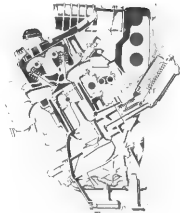
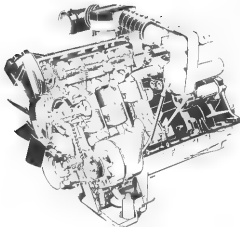
Vacuum: at least 530 mbar

11 Engine M30

	Engine views (cross sectional view)	11- 00/3 1
11 00 038	Compression of all cylinders — check	11- 00/3 2
050	Engine — remove and install	11- 00/3 2
11 12 000	Cylinder head cover — remove and install	11- 12/3 1
100	Cylinder head — remove and install	11- 12/3 1
11 13 000	Oil pan — remove and install	11- 13/3 1
11 78 012	Oxygen sensor — replace	11- 78/3 1
	Oxygen sensor — check	11- 78/3 2

For further jobs refer to "Assembly Repair Manual"

- M 30
 - Large B cylinder
- B
 - Gasoline
- 25
 - Displacement = 100
- M = Motor and



11-00/3.2



11 00 030 CHECKING COMPRESSION OF ALL CYLINDERS

Pull off relays (1 and 2)

Notes:

Do not pull off master relay (2) in cars with EML (electric throttle valve drive).



Loosen hose clamp and unscrew nut. Remove air cleaner.

Notes:

Also disconnect terminal 1 on the ignition coil in cars with EML.



Unscrew all spark plugs.

Press down on the accelerator pedal and operate the starter motor as long until the pressure stops rising (Special tool).

10 to 11 bar (142 to 158 psi), max. deviation between cylinders = 0.5 bar (7 psi).

Installation:

Tightening torque for spark plugs = 25 Nm (18 ft. lbs.).



11 00 050 REMOVING AND INSTALLING ENGINE

Disconnect battery – see Group 00

Remove transmission – see Group 23 or 24

Unscrew splash guard

Remove radiator – see 17 11 000

Unscrew bolt and drain coolant



Unscrew nut and take transaxle & pipes off of the oil pan.



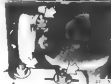
Loosen bolts (1) and nuts (2)

Turn the tensioning pinion and take off [Special tool]

Unscrew bolts and take off power steering pump. Hoses remain connected.

Installation:

Tighten drive belt and check tightness with Special Tool 11 5 020



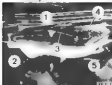
Care with Air Conditioner

Unscrew compressor

Refrigerant hoses remain connected

Installation:

Tighten drive belt and check tightness with Special Tool 11 5 020



Pull off plug (1) and unscrew nuts (2) on left and right cables.
Disconnect overflow hose (3) compensation hose (4) and vacuum hose (5).



Disconnect contact hose on heater valve (1) and heater (2).



Pull off plug (1) on ignition coil.
Loosen clamp (1) unscrew nut (2) and remove the clearance.



Loosen clamp (1) and pull off hose.
Pull off plug (2).
Loosen nut (2) and pull idle speed control wire out of brake air hose.



Pull off clamp (1) (3).
Remove air flow sensor pulling vacuum hose off of crankcase breather at some time before.
Picture shows a removed part since part is covered in installed state.



Disconnect throttle cable (1) and cruise control cable (2) on throttle cable.
Loosen bolts (3).
Adjustment:
Adjust throttle cable see Group 35.
Adjust cruise control cable see G2 185.



Disconnect plugs (1) and (2).
Disconnect connecting leads on starter.



Disconnect self reset switch plug (1).
Disconnect connecting leads on alternator.



Pull off plug (1) on carburetor valve and hose (2) on carbon canister. Loosen clamp (3) and pull coolant hose off of alternator.

Loosen hose clamps and pull off fuel hoses (1) and (2).
 Left vacuum hose (3) out of brake booster.
 Installation:
 Don't mix up hoses.
 1 = Fuel
 2 = Return

Pull off all plugs on temperature sensors and electrical head plate.

Pull off plug (1) on throttle valve switch and plug (2) on oil pressure switch. Lift out caps (3) and take off electrical head plate.



Loosen ground strap (1). Uncover nut (2) for engine mounts on left and right sides.
 Installation:
 Tightening torque for engine mounts = 45 Nm (33 ft-lbs).



Attach Special Tool 11 0 026 and lift out engine.
 Note:
 Use Special Tool 11 0 026 additionally on the front and

11-12/3.1



11 12 000 REMOVING AND INSTALLING CYLINDER HEAD COVER

Loosen clamps (1)
Pull off plug (2)
Loosen nut (3) and pull idle control valve out of intake air hose



Pull off clamps (1 - 3)
Remove air flow sensor, pulling vacuum hose off of crankcase breather at same time
Remove seal gasket on removed part, since part cannot be seen when installed



Pull off ignition leads on ignition coil and spark plug
Unscrew nuts and place ignition wire harness aside



Unscrew nuts and bolts and take off cylinder head cover installation
Check gasket, replacing if necessary
Check for correct seating oil gasket
Tighten nuts and bolts in order of 1 through 6 ensuring the idle speed control valve with nut (2)
Tightening torque = 10 Nm (7.1 lbf.ft.)



11 12 100 REMOVING AND INSTALLING CYLINDER HEAD

Disconnect battery - see Group 06
Remove splash guard
Drain engine oil
Drain coolant at radiator and engine coolant pan
Fill and bleed cooling system - see Group 17



Loosen exhaust pipe on exhaust manifold and pipe clamps on transmission connection
Coat flange of flange with copper paste CRC
Tighten nuts (1) uniformly to 10 Nm (7.1 lbf.ft.) to flange springs (2) and then loosen nuts one and one half turns
Tighten pipe with compensation, corrugated pipe section last



Remove fan - see 11 52 000
Remove suspension mounts on fan-cool at top left and right connection
Check for correct seating of top and bottom guide

Loosen hose clamp, unscrew nut and remove air cleaner

11-12/3.2

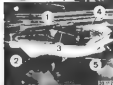


Loosen clamps (1) and pull off hose.
Pull off plug (2).
Loosen nut (3) and pull off speed control
valve pull off throttle air hose.



Pull off clamps (1 - 3).
Remove air flow sensor pulling vacuum
hose off of crankcase breather at same
time.

Note:
Picture was taken on removed part - part
1 cannot be seen when installed.



Pull off plug (1) and unscrew nuts (2) on
left and right sides.
Disconnect overflow hose (3), compensating
hose (4) and coolant hose (5).



Disconnect coolant hose on heating valve
(1) and heater (2).

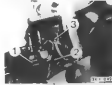


Disconnect throttle cable (1) and on air
control cable (2) on throttle valve.
Unscrew bolts (3).

Installation:
Adjust throttle cable - see Cr. 35.
Adjust cruise control cable - see Cr. 85.



Pull off plug (1 - 4).
Loosen clamps (5 and 6) and pull off coolant
hose.



Disconnect plugs (1) and (2).
Disconnect lead (3) on heater.

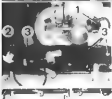


Pull off plug (1) and hose (2) on tank venting
valve.

11-12/3.3



Loosen hose clamps and pull off fuel hoses
1 and 2
Lift vacuum hose (3) out of brake booster
hose
Don't flex up hoses
1 = Fuel
2 = Return



Pull off plug (1) on throttle cable switch and
plug (2) on oil pressure switch
Lift out caps (3) and unsecure electrical lead
plug



Pull off ignition leads on ignition coil and
spark plug.
Unsecure nuts and place ignition leads aside



Unsecure cylinder head cover
installation
Check gasket replacing if necessary
Check for correct seating of gasket
Tighten bolts in order of 1 through 8
securing the idle speed control on both
bolts (2)
Tightening torque = 10 Nm (7 ft. lbs.)



Set cylinder number 1 to TDC
Remove upper timing case cover - see
11-14-100
Remove piston for other cylinder - see
11-21-060
Unscrew sprocket



Installation
Mount timing chain that aligns pin (1) at
bottom left when tapered faces are perpendicular
to the engine
Tightening torque = 10 Nm (7 ft. lbs.)



Disconnect hose



Unscrew support

11-12/3.4



Remove cylinder head bolts in order of 14 through 1 (see next picture).
Insert Special Tools 11 1 063 as shown in picture to prevent displacement or turning of rocker arm shafts.
Lift off cylinder head.



11-12/4



11-12/5

Attention

Replace cylinder head gasket - see 11 12 101

Mount cylinder head and tighten bolts involved and lubricated with oil in order of 1 through 14 in three steps

Step 1

Tighten bolts 1 through 8 first, then remove Special Tools 11 1 063 and tighten bolts 7 through 14 afterwards.
Tightening torque = 60 Nm (43 ft. lbs.)

Wait 20 minutes.

Step 2

Tightening torque = 60 Nm (58 ft. lbs.)

Run engine warm 20 minutes.

Step 3

Torque angle = 35°

Important

Keep oil out of cavities in engine block (danger of cracking block, reduced torque return)

11-13/3.1



11-13-000 REMOVING AND INSTALLING OIL PAN

Remove fan — see 11-52-000

Lift suspension mounts out of fan (see 11-52-000) and remove fan cover.

Check for correct seating of guides.

Loosen hose clamp, unscrew nut and remove air cleaner.



Unscrew nuts (1) on left and right joints. Pull off plug (2) and hose (3) and place coolant suspension tank aside.

Check for correct seating of guide (4).



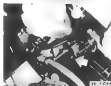
Remove splash guard.

Loosen nut (1).

Unscrew both (2) and wing holder for power steering pump (see 11-55-000).



Unscrew nut and take off oil pan, with (see 11-56-000).



Draw engine oil pan (see 11-57-000) and disconnect plug for oil level switch.



Unscrew exhaust pipe bracket.



Unscrew ground strap (1) and engine mount (2) for engine mount on left and right sides.

Tightening torque for engine mounts — 45 Nm (32.5 ft. lbs.).

11-13/3.2



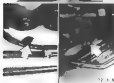
Apply Special Tool 00 0 200.
Attach chain and checks of Special Tool
11 0 020 on engine and left engine

Unscrew oil pan bolts and take off oil pan

Installation
Clean cooling surfaces.
Replace oil pan gasket
Coat joints on timing case cover and

and cover with brush on universal sealing
compound (Three Bond 1207**)
Tightening torque = 10 Nm (7 ft. lbs.)

** Source of Supply: HWD



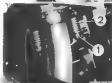
11 78 012 REPLACING OXYGEN SENSOR

Disconnect plug for oxygen sensor

Unscrew nuts and take off electric lead holder

Car with Automatic Transmission
Unscrew nuts and left nut holder (1)
Continuation
Tightening torque = 22 Nm (16 ft. lbs.)

Support exhaust assembly with Special Tool
00 2 020
Left nut holder (1) on left and right
sides



Loosen nuts on connectors between exhaust
pipe and exhaust manifold several turns.

Install pin
Torque nuts (1) uniformly to 10 Nm (7 ft.
lb.) to bottom spring (2) and then loosen
nuts again by one and one half turns.
Tighten pipe with compensation tool

Unscrew nut on holder for fuel line, if any
Loosen exhaust assembly slowly far enough
that the oxygen sensor is accessible

All Models
Unscrew oxygen sensor (1)
Installation
Coat threads with Anti-Seize***
Torque oxygen sensor to 55 Nm (40 ft. lbs.)
tight

Never clean oxygen sensor and never let
them have contact with lubricants
- Cover oxygen sensor when undercoating
car



11 78 OXYGEN SENSOR

A. Checking Heating

Disconnect plug for oxygen sensor



Connect ohmmeter on jacks 3 and 4 (toward oxygen sensor) and measure the resistance (nominal value < 5 ohms)

- 1 = Plug for sensor voltage
- 2 = Plug for sensor voltage
- 3 = Jack for sensor heating
- 4 = Jack for sensor heating



12 11 1

B. Checking Signal Voltage

Perform the "Oxygen Sensor Voltage" status call within the scope of DME self diagnosis. This value is measured at idle speed with the oxygen sensor connected and oxygen sensor control switched on (about 1 to 2 minutes after starting the engine) and should be between 0.02 and 0.85 V

If a constant voltage of 0.45 V is measured the oxygen sensor is not working (oxygen sensor or power supply lead faulty)

11 Engine S38

11 00 050	Engine – remove and install	11- 00/8 1
11 12 500	Cylinder head – remove and install	11- 12/8 1
11 34 004	Valve clearance – adjust	11- 34/8 1
11 53 000	Coolant thermostat – remove and install or replace	11- 53/8 1
11 62 140	Exhaust manifolds, both – remove and install/seal or replace	11- 62/8 1

For further jobs refer to "Assembly Repair Manual"

11-00-050 REMOVING AND INSTALLING ENGINE

Note

If jobs have to be performed on a removed engine, which makes it necessary to unscrew the central vibration damper mounting bolt, it must be loosened prior to removal of the engine.

Precaution

This bolt is torqued with about 500 Nm (370 ft. lbs.) and therefore too difficult to loosen on a removed engine.

Tighten the central bolt after installation of the engine to these procedures (loosening is in reverse order).

Crack the engine until the TDC mark faces down perpendicularly.

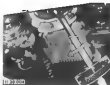
Unscrew pulley

Apply Special Tool 11-2-340 until the level arm faces down perpendicularly. Mount special tool in all of the bolts. Bolt size: 8 x 20 mm.

Note

The hole pattern in the flange is asymmetric. All bolts can only be screwed in in this position.

Have Special Tool 11-3-230 bear on the right-hand side of the engine center. Apply Special Tool 11-3-230.



Tighten central bolt with a torque wrench and wrench socket.

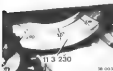
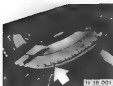
Procedures

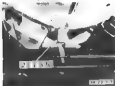
Step 1 : 50 Nm (42 ft. lbs.) torque

Step 2 : 90° torque angle

Step 3 : 50° torque angle again

Step 4 : 30° torque angle again





REMOVING AND INSTALLING ENGINE

Disconnect battery ground lead.

Removing Transmission

See Group 25

Note:

Always use Special Tool 22 1 330 for removal of the transmission.

Removing Engine Hood

See Group 41

Note:

Supply lines of windshield spray jets do not have connection points, so that the windshield washing hose and wire harness for spray jet heating have to be removed prior to removal of the engine hood.

Removing Radiator with Engine Oil Cooler and Fan Core

See Group 17

Drain remaining coolant on engine.



Removing Fan

Counterhold on pulley with Special Tool 11 5 030 and unscrew coupling nut (1).

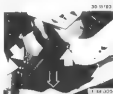
Important:

Left hand threads = turn clockwise to

Installation:

Tightening torque*

Tighten fan with Special Tool 11 5 040 40 Nm (29 ft. lbs.) tightening torque is equal to 20 Nm (15 ft. lbs.) setting on a torque wrench.



Removing Air Guide for Alternator

Unscrew air guide.

Loosen hose clamps.

Take off air guide together with connectors.



Removing Power Steering Pump

Loosen bolts (1) and nut (2).

Turn tensioning pinion and take off drive belt.

Unscrew bolts and take off power steering pump.

Hoses remain connected.

* See Specifications





Installation
Tighten drive belt
Tighten locked element with torque of 8 to 8.5 Nm (5.8 to 6.1 ft. lbs.) and lock.
Check drive belt tightness with Special Tool 11 5 020, connecting if necessary Hook (4) bears on tip of a tooth.

Important!
Remove the tester to tighten the belt and apply it again only after tightening has been completed.

Removing A/C Compressor

Loosen air pump bolts.
Turn tensioning pinion and take off drive belt

Installation
Tighten drive belt.
Tighten locked element with torque of 8 to 8.5 Nm (5.8 to 6.1 ft. lbs.) and lock.
Check drive belt tightness with Special Tool 11 5 020, connecting if necessary Hook (4) bears on tip of a tooth.

Important!
Remove the tester to tighten the belt and apply it again only after tightening has been completed.

Unscrew compressor
Refrigerant hoses remain connected



Unaccreting Engine Mounts

Unscrew left and right engine mounts.
Unscrew ground strap on engine carrier

Removing Air Cleaner and Air Flow Sensor

Take off cover for headlights.
Pull off plugs
Loosen nuts
Loosen hose clamps
Lift out air cleaner with air flow sensor

Put off intake air temperature sensor plug.

Disconnecting Throttle Cable and Scales Control Cable

Unscrew holder
Undo p cables on throttle valve lever



Disconnecting Coolant Hoses

Disconnect hoses and plug on expansion tank.
Remove expansion tank



Disconnect coolant hoses on heater and heater valve



Note
Tilt engine forward as far as possible by inserting a wooden wedge in addition to Special Tool 23-1-330



Disconnecting Vacuum Hose for Brake Booster

Pull connector out of the brake booster



Disconnecting Air Pump Supply Hose

Loosen hose clamps.
Disconnect supply hose on air cleaner



Disconnecting Fuel Pipes and Hoses

Disconnect feed and return pipes.

- 1 = Feed
- 2 = Return



Arrangement of Fuel Pipes on Tank Pipes

- 1 = Feed
- 2 = Return

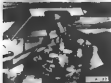


Disconnect tank venting hose on valve



Disconnecting Engine Wire Harness in Car

Lift out covers.
Unscrew starter lead on connection point.



Lift out cover



Remove covers



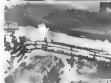
Unscrew cover on electronic box



Pull off ignition leads on ignition coil.
Lift off cap.



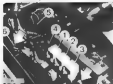
Unscrew leads (1 and 15) on ignition coil.
Unscrew electric lead on ground connection point.



Unscrew holder.
Remove all electric lead straps.



Pull off plug on control unit.
Disconnect plugs (1 and 2).



Unscrew electric lead on positive (+) connection point.
Lift out relays (1 - 3) with sockets.
Disconnect plugs (4 and 5).
Pull off plug on temperature sensor (6).



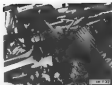
Unscrew relay holder



Lift out control unit located underneath.
Pull off plug



Unscrew holder for rubber grommets.
Installation:
Insert retaining pin in provided bore



Pull out wire harness with rubber grommet

Note:
Suspend the wire harness from hanging in the car on the engine compartment wall with a piece of wire



Unscrew diagnosis socket.
Disconnect engine wire harness plug (bayonet connection).



Unscrew holder

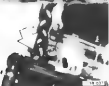


Loosen electric lead strips.
Pull out wire harness.

11-00/8.7



Artech Special Tool 11 0 020 on engine
Lift out engine.



Important!
Guide the rear chain between the
make neck and check valve.

Installation
Check power steering hose routing



Installation
Check air conditioner hose routing

11 12 500 REMOVING AND INSTALLING CYLINDER HEAD

The engine has to be removed to carry out repairs correctly.

Remove engine - see 11 00 000.

Remove and disassemble cylinder

head - see Group 11 in the Construction Group Repair Manual.



11-34-004 ADJUSTING VALVE CLEARANCE

Remove fan cover and fan refer to 11-12-000
Remove cylinder head cover refer to 11-12-000

Crank engine using Special Tool 11-3-000

Measure valve clearance with cams facing up
Compare measured valve clearance with specified valve clearance*

Measured Valve Clearance Outside of Specifications:
Turn opening of tappet as shown



Use Special Tool on MTRD engines or Special Tool 11-3-170 on 535 engines, guide it appropriately to camshaft "A" or "B" and press down on the tappet

A = Exhaust
B = Intake

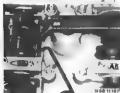
Note
Plastic cover and wiring holder must be removed for adjustment of intake valves in cyl. no. 8

Cut off cable grip and remove holder

* Refer to Specifications



Press wire harness aside



Blow out valve stem with air pressure

Measure the removed valve shim
Install shim in correct thickness with the
lettering facing down



11-53/8.1



11-53-000 REMOVING AND INSTALLING OR REPLACING COOLANT THERMOSTAT

Note

Procedures are shown on a removed engine in some cases for better understanding.

Drain coolant.

11-53-000

Disconnect coolant hoses on thermostat housing to the coolant pipe.

11-53-000

Unscrew bolts.

Lift off thermostat housing.

11-53-000

Put thermostat out of housing.

Installation

Replace rubber seal on coolant port.
Check installed direction of thermostat.

11-53-000

11 62 140 REMOVING AND INSTALLING SEALING OR REPLACING BOTH EXHAUST MANI- FOLDS

M 8 Models

Note

Some of the procedures are shown on
a removed engine for better under-
standing.

Remove exhaust assembly - see
11 62 140

Drain some of the coolant.



11 62 001



Unscrew right engine mount and
ground strap.

Unscrew air injector bolt.
Unscrew holder for heat shield.



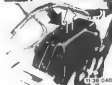
11 62 044



Remove fan cover



Remove coolant expansion tank.



Remove air pump housing for air pump



Apply Special Tool 00 6 290
Lift engine out of the right engine
mount as far as possible

00 6 290

11 62 046

Unscrew and remove heel shield.



11-38 047

Unscrew air injection pipe.

Note:

Use Special Tool 11-5-070.



11-5-070

11-38 048

Important:

Unscrew mounting tab on exhaust manifold at cylinder no. 1.



Attention:

Replace gaskets.



Unscrew coolant pipe.



Important:

Replace seats.



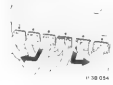
11-5-070

11-38 053

Unscrew both exhaust manifolds on cylinder head.

Note:

Use Special Tool 11-5-070.



11-38 054

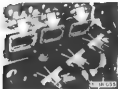
Lift both manifolds off of staybolts.

Push them as far as possible.

Push out the front manifold forward.

Remove the rear manifold.

11-62/8.3



Installation

Graphite surfaces of pistons face the cylinder head.

Use new self-locking nuts.

Tightening torque = 10 ± 3 Nm
(7.5 ± 2.2 ft. lbs.)

11 Engine M40

00 00 249	BMW engine oil service	11- 040 1
11 00 039	Compression of all cylinders – check	11- 040 2
050	Engine – remove and install	11- 040 3

For further jobs refer to "Assembly Repair Manual"

00 00 249 BMW Engine oil service

M10

Change engine oil and oil filter



Unlocks oil filter cover

Note

Drain out oil from the oil filter housing into the oil pan.

Installation

Replace the sealing ring.
Tightening torque 11.62 [Nm]

Installation

Replace sealing ring on oil filter cover and on the pump.



Remove oil filter. Asset

Refer to Technical Data



Once the oil has drained out of the filter housing, open the oil drain plug or drain off the oil using suction.

Installation

Replace the sealing ring.
Tightening torque 11.62 [Nm]

Pour in engine oil

Switch on engine and run at idle speed until the oil level gauge reads.

Switch off engine and check oil level.

Note

Park vehicle on even surface.

* Refer to Technical Data

11 00 039 Checking compression of all cylinders

W00

Caution:
High voltage - danger to life!

Interrupt power supply to ignition coils (disconnected terminal 1 from ignition coils).
Disconnected fuel pump relay, refer to Electrical Troubleshooting Manual (see manual).
Series 5 (USA) location directory for components 7000.0
Installation location - Electronics box

Unscrew and remove all spark plugs
see 12 52 011

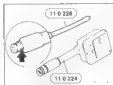


Note:
Special tools 12 0 182 186 187 can be re-used!



Depress accelerator pedal and operate starter until compression pressure reaches its maximum level and stops rising.

Compression pressure*



Screw special tool 11 0 226 into tapped hole for spark plug of cylinder to be tested by hand. Connect up special tool 11 0 224 (compression tester).

Note:
Check that seal is in perfect condition.

* Refer to Technical Data

11 00 050 Removing and installing engine

W&D

Read out error messages of all control units
Disconnect battery negative lead

Remove transmission
refer to 23 00 022 24 00 025



40 1 10010



51 1

Caution
Left-hand (new) threads

Slide against pulley wheel with special tool 11 5 050
Remove cap nut from water pump with special tool 11 5 040
Remove fan wheel and fan coupling from water pump and remove together with fan shroud

Reassembly
Tightening torque 11 52 1A2 *

Note
Tightening torque of 40 Nm when using special tool 11 5 040 is equivalent to 30 Nm on the scale of a torque wrench

Remove radiator
refer to 17 15 000

Refer to Technical Data



Disconnect coolant hoses on engine



Disconnect coolant hoses from heating unit and heating valve



Disconnect plug connection from volume air flow sensor
Remove upper section of air filter together with volume air flow sensor



Remove water pump for power steering from engine and its back to one side

Note
Lines remain connected

51 1

Before operating (Bowditch) cable for accelerator control from throttle, refer to 35 and 421 Repair Manual 3 Series P 58.



(a) Fuel line

Caution

Collect any fuel flowing out and dispose of suitably.

Remove fuel supply and return lines
Unclip fuel lines from throttle

Installation note

- (1) Fuel supply from fuel filter
Pipe: bare
- (2) Fuel return
Pipe: painted black

Replace fuel hoses.



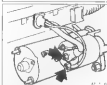
Remove connection piece from brake booster



Remove HT lead from ignition coil



Remove electrical connections from alternator



Remove electrical connections from starter



Disconnect both plug-and-socket connections from cable duct

Installation note

- (1) Cylinder reference sensor
- (2) Pulse generator for DME

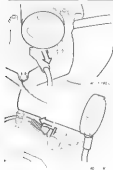


Disconnect plug connector from idle speed control valve.



Disconnect plug connector from pressure switch.

Note:
Installation location on oil filter housing.



Disconnect plug connector from throttle valve potentiometer.

Disconnect plug connector from tank vent valve.

Remove tank vent hose from throttle body.



Unfasten clip on hose to expansion tank.
Unfasten upper screw connection for manifold support.



Unfasten upper screw connection for manifold support.
Unfasten screw connection on valve duct.



Disconnect both plug connectors on temperature sensors on cylinder head.



Disconnect plug connector from injection valve stop.

Note:
Plug connection on end of cable duct, near the fuel lines.

Note electric wire channel on one side.



Attach engine to special tool 11 0 002



Front and rear suspension arrangement

Ground cable and engine mount, (left, right) units/new

Installation:
Tightening torque 51.81 N.m

Lift out engine

11 Engine M43

11 00 050 Engine – remove and install

11- 043 1

For further jobs refer to "Repair Manual 3 Series E36"

11 00 050 Removing and installing engine

(M3)

Observe note on Disconnecting and connecting battery.
refer to General Information M312

Release coolant drain plug on RH side of engine block.
Drain coolant and dispose of suitably.

Installation note
Fit sealing ring.
For tightening torque refer to Technical Data 11 11 5A2

Remove radiator refer to 11 11 000



Disconnect negative battery lead.
Disconnect positive battery lead.
Remove battery.



Remove battery tray



Release plug-and-socket connection.
Remove air cleaner with air mass meter



Disconnect coolant hoses from engine, heater and heating valve

Remove transmission.
refer to 23 00 32

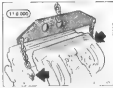
Remove upper section of manifold.
refer to 11 01 060
Repair Manual 3 Series 638

Remove cable duct from bottom section of manifold. Disconnect engine section of wiring harness from engine and place to one side.

Installation note
Plug connector assignments, refer to 41 11 051
Repair Manual 3 Series 638

Remove bottom section of manifold,
refer to 11 01 044
Repair Manual 3 Series F.36

Release ignition coil,
refer to 12 02 012
Repair Manual 3 Series F.36



Attach engine to special test 11 0 005



Caution!
Collect any fuel flowing out and dispose of suitably
Release fuel supply and return lines
(1) Fuel supply
(note fuel filter pipe - bare)
(2) Fuel return
(pipe - painted black)
Replace fuel hoses



Release ground lead
Release upper engine mounts on left and right,
a. fit out engine

Release power steering pump from alternator
support bracket and tie to one side,
refer to 32 44 060
Repair Manual 3 Series F.36

Note
Lines remain connected



Remove from manifold support bracket with
lifting bracket.

11 Engine M50

00 00 249	BMW engine oil service	11- 00/50 1
11 00 038	Compression of all cylinders check	11 00/50 1
050	Engine – remove and install	11- 00/50 2
11 13 000	Oil pan – remove and install seal or replace	11- 13/50 1
	• Fan shroud – remove	11- 13/50 1
	• Fan – remove	11- 13/50 1
	• Power steering pump – remove	11- 13/50 1
	• Oil dipstick tube – remove	11- 13/50 2
	• Oil pan – unscrew	11- 13/50 2
	• Pickup tube for oil pump – remove	11- 13/50 2
11 14 110	Bottom timing case cover – remove and install, seal or replace	11- 14/50 1
	• Cylinder head cover – remove	11- 14/50 1
	• Thermostat housing – remove	11- 14/50 2
	• RPM sensor – remove	11- 14/50 2
	• Mounting bracket for tensioner pulley – remove	11- 14/50 3
	• Pulley for water pump – remove	11- 14/50 3
	• Hub for vibration damper – remove	11- 14/50 3
	• Timing case cover – remove	11- 14/50 4
11 31 001	Camshaft (M50) (inlet or exhaust end) – replace	11- 31/50 1
	• Camshaft – remove	11- 31/50 1
001	Camshaft (M50 VANOS) (inlet or exhaust end) – replace	11 31/50 8
11 36	Function description VANOS (variable camshaft control)	11- 36/50 1
	Control Unit (VANOS) – troubleshoot	11- 36/50 1
000	VANOS – check function	11 36/50 2
010	VANOS control unit – remove and install or replace	11- 36/50 3
550	4/2-way valve for VANOS – check or replace	11-36/50 10

For further jobs refer to "Assembly Repair Manual"

00 00 240 BMW engine oil service

M30

Refer to 00 00 240

Repair Manual 3 Series E30

11 00 030 Testing compression of all cylinders

M30



Caution

Caution

High voltage - risk of fatal injury!

Disconnect power supply to ignition coils

Observe safety on compression testing.

Refer to General Information BIC-17

Repair Manual 3 Series E30

Disconnect fuel pump relay and DME main relay (location: E box), refer to Technical Troubleshooting Manual "Schematics" 3 Series E30
7006.4 Component location chart

For further procedure, refer to 11 00 030

Repair Manual 3 Series E30

Read out defect code memory

Repair defect if necessary

Delete defect code memory

11 00 000 Removing and installing engine

M50

Observe notes on disconnecting and connecting battery, refer to General Information MG12
Repair Manual 2 Series 830

Remove transmission, refer to 14 00 002 01 00 002 003 (4-wheel drive)

Note

Additional jobs on 4-wheel drive
Remove stabiliser bar refer to 21 30 000
Remove left and right output shafts refer to 14 00 000

Disconnect negative battery lead
Disconnect positive battery lead
Remove battery

Remove battery tray

Remove covers



Remove intake duct for alternator cooling air



Remove plug-and-socket connection.
Remove hose clip and retaining screws.
Remove air cleaner with an engine water



Caution!
Left-hand thread
Hold pulley with special tool 11 5 036 and release clutch reel with special tool 11 5 040 from water pump





Installation note

Fully load fan with special tool 11 5 040.
 For tightening torque,
 refer to Technical Data 11 52 1 A2.

Note

When using special tool 11 5 040, a reading of
 50 Nm on the scale of the torque wrench corre-
 sponds to a tightening torque of 40 Nm.

Remove radiator, refer to 17 11 000.



Lift out expanding rivet on left and right.



Remove coolant hoses from engine, heating
 valve (1) and heater (2).



Detach fan with fan clutch from water pump
 and lift upwards together with fan shroud.

Remove throttle operating (choke) cable.
 This job is described under removing throttle
 body, refer to 13 54 000.



If necessary, move protective plate.

Drain oil coolant at engine block and dispose
 of suitably.

Installation note:
 Repave gasket.
 For tightening torque,
 refer to Technical Data 11 11 5 A2.

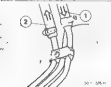


Disconnect hose for tank ventilation.



Disconnect hoses for throttle positioning

Remove injection tube, refer to 13-84 150



Caution
Collect any fuel flowing out and dispose of suitably
(1) Fuel return line
(2) Fuel supply line (from fuel filter)
Remove fuel hoses

Installation note
Replace fuel hoses



Injecting hose for idle speed control valve from manifold

Note
Figure shows connection from below (not in 504 of vehicle)



Remove connection piece from brake booster

Caution
Close off connection hole

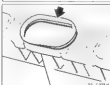


Remove intake air manifold

Caution
Make sure no parts fall into the ports



Disconnect hoses for cylinder head ventilation



Installation note
Replace seals



Disconnect engine section of wiring harness from engine.
Release cable duct.
Place wiring harness to one side.

Installation note:
Plug connector assignments.
refer to 81 13 030



Remove cap from tensioner pulley



Fit hexagon socket wrench in groove for tensioner pulley.
Tensioning element (H) is pressed together by slowly turning in clockwise direction.
Lift off drive belt.



Location of drive belt

Installation note:
Ensure it is fitted correctly in groove. Check drive belt for wear and oil residue, replace if necessary.
The drive belt must be replaced if coated with hydraulic oil.



Remove power steering pump.

Note:
Lines remain connected



Location of rear mounting

Screw special tool 11 0 050 from above into support bracket on engine block.



Location of front mounting.



Attach special tool 11 0 050 to front and rear of engine tension chain.



Release engine mount and ground seat on right.



Release left engine mount

Lift out engine

11-13/50.1



11 13 000 REMOVING AND INSTALLING SEALING OR REPLACING OIL PAN

a. Removing Fan Cover

1. 18 left and right expansion rivets out.

2. Pull fan cover out upwards.

Precaution:
Engage left and right tabs, (1) in borders (2) when inserting the fan cover.

b. Removing Fan

Counterhold on pulley with Special Tool 11 5 030 and unscrew coupling nut from fan.

Notes:
Different belt distances.

Important!
Left-hand threads.



Precaution:
Tighten fan using Special Tool 11 5 040 and the tightening torque is equal to 30 Nm on scale of the torque wrench.



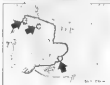
c. Removing Power Steering Pump

1. Slacken drive belt in left wrench socket (see belt for the retensioning wheel).

2. Remove drive belt.



Precaution:
Layout of drive belt.
Check for correct seating in the grooves.



1. Unscrew power steering pump from engine and suspend from car on a piece of wire. Pipes remain connected.

Precaution:
Tightening torque*

* Refer to Specifications



Unscrew oil drain plug and drain the oil

Insulation
Tightening torque:

Insulation
Pour in engine oil:

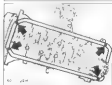
Start and run engine at high speed (approx. 1500 rpm) until the oil control lamp goes out (about 5 seconds).

c. Removing Guide Tube for Oil Injection

Unscrew and pull guide tube out

Insulation
Replace seal

Refer to Specifications



a. Unscrewing Oil Pan

Unscrew all bolts and lower oil pan to the front axle center

Put oil pan out towards the rear after removing the oil pump intake

Insulation
Replace gasket

Fill in points between the front end of the chain case and rear end of the end cover with permanent y-elastic sealing compound 2 Bond 1257B (black)

b. Removing Oil Pump Intake

Unscrew intake pipe

Insulation
Tie on gasket points to intake pipe.

Source of Supply: BMW Parts



11 14 118 REMOVING AND INSTALLING SEALING OR REPLACING LOWER TIMING CASE COVER

Removal of pan refer to 11 13 000.



11 14 118 11

Remove ignition coils

In situation:

Place paper gasket between valve cover and ignition coil (for galvanic separation).



11 14 118 12

a Removing Cylinder Head Cover

Unscrew cover for ignition coils.



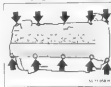
11 14 118 13

Unclip connection for cylinder head vent



11 14 118 14

Note
Lift cover horizontally, put it forward and then swing it out over the oil filler neck.



11 14 118 15

Unscrew cylinder head cover



11 14 118 16

Pull plugs off of ignition coils.
Remove plug and complete with electric



11 14 118 17

Note
Cylinder head cover is separated from the cylinder head in regards to transmission of oscillation by using rubber mounts and gaskets.
Correct arrangement of rubber elements



Installation
Check gaskets, replacing if necessary.
Place gaskets on cylinder head.



Installation
Make sure of correct seating of gasket on back of cylinder head when mounting the cylinder head cover.



Removing Thermostat Housing
Drain coolant.
Disconnect water hoses from thermostat housing.



Disconnect water hoses behind the oil filter.



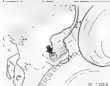
Unscrew suspension eye.
Unscrew thermostat housing.



Installation
Replace gasket.



Installation
Check installed direction.
Vent on arrow faces up.
Replace O-ring.



Removing Speed Sender
Unscrew sender.

c Removing Tensioning Roller Console

Take off cover

Unscrew tensioning roller

Unscrew console

NOTE
The hydraulic belt tensioner is filled with oil, so that a removed element must always be stored standing upright. Improperly stored elements can normally be bled by compressing several times.

Installation
Check installed direction

e Removing Pulley for Water Pump

Hold pulley tight on the drive belt and unscrew bolts.

Installation
Tightening torque

d Removing Vibration Damper Hub

Unscrew vibration damper bolts and take off vibration damper

Installation
Align dowel pin bore in vibration damper with the dowel pin. Tightening torque

Apply Special Tool 11 2 150

Unscrew central bolt
Take off washer and hub

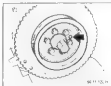
See Specifications



11 2 150



11 2 150



11 2 150



11 2 150



11 2 150

11 2 150

11 2 150



No. 11 3014

Installation
Position hub that groove and woodruff key are aligned.
Shoulder of washer flange hub.
Central bolt tightening torque = 410 Nm.



No. 11 3014

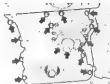
Installation
Press in new radial oil seal. Push using Special Tool: 11 3 280 together with the central bolt with the timing case cover mounted.

c. Removal of Timing Case Cover

Drive out dowel pins on timing case cover towards rear (diameter of punch less than 3 mm).

Unscrew timing case cover from cylinder head.
Pull up bolts.

No. 11 3014



Unscrew timing case cover from engine block and lift off cover.



Installation
Clean seating surfaces.
Drive dowel pins into timing case cover that they protrude by about 2 to 3 mm.



Installation
Press new gaskets on timing case cover with a small amount of grease.



Installation
Produce beads of permanently elastic sealing compound* on left and right front ones to the cylinder head gasket.

11-14/50.5



Installation

Mount cover and screw in screen finger tight.



Installation

Drive in dowel pins flush from front and

Installation

Tighten bolts on cylinder head and engine block alternately and uniformly in several steps.
Tightening torque:

**1 1/2 In. Dia. REPLACING CAMSHAFT (M60)
(Intake or Exhaust)**

Note:

Intake or exhaust camshaft can be replaced in the car.

Remove fan cover

**Remove fan using Special Tools 11 5 030
and 11 5 040.**

Note:

Left-hand threads.

Important:

Set torque wrench to 30 ft-lb and tighten fan bolt using Special Tool 11 5 040.

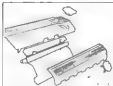
c. Removing Camshaft

Caution:

The camshaft could be damaged or broken if it is removed. Insulate without use of special tools.

Valves could also be bent through contact with the piston crowns.

Contemplate with procedures and as quickly as absolutely essential.



Remove cover.



Note:

Lift cover horizontally, pull forward and then swing it out over the oil filler neck.

Unhook ground strap on timing case cover



**Unscrew screws (1 and 2)
Pull off plug rail**

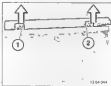




Fig. 1 100-10

Attention:
Watch out for rubber seal.



Fig. 2 100-10

**Pull plugs off of ignition coils.
Remove plug cap together with wires.**



Fig. 3 100-10

Remove ignition coils.



Fig. 4 100-10

Unplug connection for cylinder head vent.



Fig. 5 100-10

Remove cylinder head cover.



Fig. 6 100-10

Note:
Rubber insulator and gaskets separate the cylinder head cover from the cylinder head to prevent transmission of vibration.
Check arrangement of rubber insulators.



Fig. 7 100-10

Attention:
Check gaskets, replacing them if necessary.
Place gaskets on cylinder head.



Fig. 8 100-10

Attention:
Check for correct seating of the gasket on the back of the cylinder head when installing the cylinder head cover.



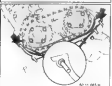
Remove sensor.
Installation
Check seal, replacing it if necessary



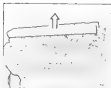
Remove wiring dust



Unscrew suspension eye and upper timing arm cover



Installation
Replace gasket
Check for axial sleeves



Remove bolt



Crank engine in its direction of rotation until the peaks of intake and exhaust camshafts in cylinder no. 1 face each other. Arrows on the sprockets point up

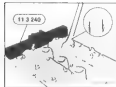


Set crankshaft in TDC position using Special Tool 11-2-300

Important
Remove special tool before operating the engine



Unscrew both valve cover mounting studs

**Important**

Align and hold cam shaft in position using Special Tool 11-3-240.
Camshaft can be turned on the hexagon using a 24 mm wrench.

Important

Don't damage the bearing strip.
If necessary, machine the open-ended wheel accordingly.

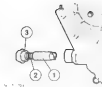


50 11-300-0

Important

If the camshaft alignment has to be corrected to such an extent that valves are moved to cylinders 1 and 6, first turn the crank shaft in the engine in direction of rotation approx. 30° away from TDC and then turn the camshaft back.
This prevents contact between valves and piston crowns.
Install both chain tensioners after assembly has been completed.
Crack engine lateral strips in the direction of rotation.

Recheck camshaft alignment.

**Uncrew bolt (3)****Catch**

Bringing spring force

Remove spring (2) and plunger (1)

Installation

Insert chain tensioning plunger (1) in such a manner that guide teeth engage in the tensioning rail.
Install spring (2) and bolt (3).

Replace seal.

Tightening torque



Press down on upper chain tensioner and spring by inserting Special Tool 11-3-290.

**Uncrew sprockets**

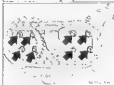
Lift off both sprockets together with the chain.

Installation

Arrows on the sprockets point up.
Tightening torque



Installation
Apply guide pin into the guide camshaft.



Installation
Tighten bolts only after checking correct
top of the chain system and lower chain
tensioner as well as loosening the upper
chain tensioner.
Tightening torque:



Unscrew capscrews for upper chain tensioner



Unscrew chain guide

Refer to Specifications



Roller sprocket together with chain

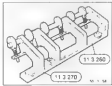


Important!
Use a piece of wire to prevent the chain
from sliding down.



Important!
Arrow on the sprocket points up.

Mount sprocket. A such a reminder that the
recessed bolts are on the left hand side of
the sprocket. As loosening the roller sprocket
will cause the sprocket to be turned to the
left.



Prepare Special Tool 11-3-266 for a six cy-
linder engine



Inter-seat spark plugs

Apply special tool and compress into spark plug tapered bore right.
Tightening torque = 23 Nm.

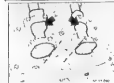


Apply tension on bearing caps by turning the eccentric shaft.
Unscrew all bearing cap bolts.

Installation
Tightening torque*

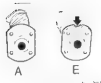


Loosen and remove special tool.
Lift out bearing caps and camshafts.



Precaution
Install camshafts that peaks of cam for intake and exhaust valves in cylinder No. 1 face each other.

* Refer to Specifications.



Installation
Identification of camshafts on bearing caps

E Intake camshaft
A Exhaust camshaft



Identification on front end of camshafts

Intake
E Intake
A Exhaust

Exhaust
A 2-3 stop
E 2-3 stop

Example
EB = Intake 2-3 stop



Bearing caps are marked
A/E for the exhaust side or
E/A for the intake side
whereby the marks can be read from the
middle side.



Both valve clearance compensators right
using Special Tools 11-3-260

Lift out bearing strip complete with valve
cappets.



Installation

Check for centering sleeves on mounting studs for bearings 7 and 7



Installation

Bearing strips are marked with 'A' for the outer side or 'B' for the inner side



Inspection

Inspect bearing surfaces of valve clearance compensators for wear scoring

11 31 001 Replacing camshaft
(MSD VANOS) (intake or
exhaust end as required)

Refer to 11 31 001 (MSD VANOS)
Repair Manual 3 Series 63d

11 36 DESCRIPTION OF VALVE (Variable Camshaft Control)

The control unit is actuated by the permanent engine control unit. The control unit operates a regulating element via a solenoid. In this manner engine oil pressure is supplied to both sides of a hydraulic plunger.

The hydraulic plunger is held in one of both possible positions by way of mechanical stops and applied engine oil pressure. A rotating splined shaft gear is integrated in the hydraulic plunger. This splined shaft gear uses its radial level splines to convert the plunger stroke into rotation of the camshaft relative to the driven chain sprocket.

Hydraulic plungers with the splined shaft gear are located in a pressure cast aluminum housing on the top end of the cylinder head, closed to the intake camshaft.

The nominal positions of the intake camshaft, advanced or retarded, are different for M50 B20 and M50 B25 engines. Adjustment of the camshaft is actuated by the permanent engine control unit depending on engine load, engine speed and coolant temperature.

The 4/3 way operating valve is designed in such a manner that when one pressure chamber is pressurized the other is without pressure (deadback). As soon as the operating valve is solenoid recessed (current is removed) the control piston against spring force finds advanced position via an annular, 4 ball spring is provided for return to the retracted position. Consequently the camshaft is automatically adjusted in retarded direction in case of a faulty solenoid or activation failure.

In this manner it is as possible to stop the engine even when the control unit fails. It would not be possible to start the engine with the camshaft adjusted in advanced timing direction.

The control edges of the valve are designed in such a manner that the emergency operation properties of the engine are guaranteed even when the control piston would take an unintended intermediate position.

11 36 TROUBLE SHOOTING VALVE CONTROL UNIT

Interrogate the fault memory of the engine control unit. If no faults are stored in the memory, refer to "Checking Function of VALVE" in 11 36 000.



M50 B20 engine are fitted with an engine control unit from "Bosch" Designation: ME-MD 1.

Faults which could be stored in the control unit's fault memory:

- 1) Feedback of intake camshaft's position. If the camshaft is not adjusted or only adjusted inadequately after activation and triggered operation, this is stored in the fault memory.
- 2) Testing of final stages.
- 3) Short to positive.
- 4) Short to ground.
- 5) Breaks or wiring.

M50 B25

M50 B25 engine are fitted with an engine control unit from "Bosch" Designation: ME-MD 2.

Faults which could be stored in the control unit's fault memory:

- 1) Testing of final stages.
- 2) Short to positive.
- 3) Short to ground.
- 4) Breaks or wiring.



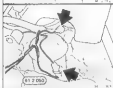
11 36 000/Checking function of VAMOS

Interrogate fault memory of the engine control unit

The VAMOS control unit plug is located behind the oil filter head back on the engine wire harness.



Remove air guide for alternator
Disconnect plug



Connect special tool 81 2 050 on engine wire harness and solenoid



Switch on ignition.
Connect special tool 81 1 476 to one pin of the 2-pin plug of special tool 81 2 050.
Connect special tool 81 2 050 to vehicle ground.
Switching of the solenoid must be heard and felt.
If the solenoid valve fails to switch, refer to next page.



Connect special tool 81 2 050 to vehicle ground and, if the solenoid valve fails to respond, special tool 81 2 050 must be inserted in the other chamber of the trigger plug connection of special tool 81 1 476.
Again connect special tool 81 2 050 to vehicle ground.
Switching of the solenoid must be heard and felt.



Dynamic Test
Start and run engine at id speed.
Again connect special tool 81 2 050 to vehicle ground.
Engine runs extremely roughly at idle.

If the solenoid is not operated in this test, another test must be carried out with special tool 12 6 410.



Connect special tool 12 6 410 to plug of solenoid. Connect the red clip to the battery's positive connection point. Connect the black clip to vehicle ground.

Caution
Reversing the terminals on the special tool will destroy the installed diode on the VAMOS solenoid valve. The solenoid valve remains serviceable but current spikes can give rise to faults in the vehicle circuit.



Switching of the solenoid must be heard and felt.
If the solenoid is now operated, check the wiring from the engine control unit to the solenoid.
If the solenoid is not operated, also refer to Electrical Troubleshooting Manual.

11 35 010 Removing and installing or replacing VANOS control unit

11 35 010



50 1 100 1

Caution!
If disassembled assembled incorrectly, there is a danger that the valves will be bent by contact with the piston crown.
Follow order of assembly exactly.



11 5 040

50 1 141 1



50 1 20 14

Installation note
Set torque wrench to 30 Nm, tighten fan screw in conjunction with special tool 11 5 040.

Remove fan with fan clutch from water pump and remove together with fan shroud.

Remove complete air duct assembly for alternator



50 1 20 14



50 1 100 1

Remove cover

Caution!
Left-hand thread.
Tighten hood gully with special tool 11 5 030.
Release union nut with special tool 11 5 040 from water pump.



11 5 030

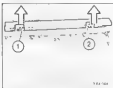
50 1 20 14

Unscrew ground strap (1) on timing case cover



1

50 1 20 14



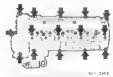
Unscrew screws (1 and 2).
Pull off plug rail



Linchpin connector for cylinder head cover



Important!
Watch out for rubber seals



Unscrew cylinder head cover



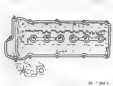
Pull plugs off of ignition coils
Remove plug rail together with wires



Note:
Rubber mounts and gaskets separate the
cylinder head cover from the cylinder head
to prevent transmission of vibrations.
1. Cap nut
2. Washer
3. Rubber mount

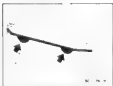


Remove ignition coils



Installation
Check gaskets, replacing them if necessary.
Place gaskets on the cylinder head

Installation
Secure ground straps on ignition coils for
cylinder no. 3 and cylinder no. 6



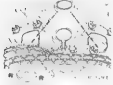
Precaution:
Check for correct setting of the gas valve on the cylinder head a backside when mounting the cylinder head cover.



Remove electric wire duct



Pull off plastic cover for the intake camshaft.



Crank engine to its position of rotation until the cam peaks of the intake and ex.haust camshaft in cylinder no. 1 point to each other.



Pull dust guard out of the special tool box.



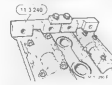
Hold crankshaft in TDC position using Special tool 11 2 300.

Caution!
Remove the special tool before opening the engine.



Unscrew studs.

Precaution:
Tightening torque*



Hold camshaft in position using Special Tool 11 2 340.

* Refer to Specifications



Screen plug out of the control unit.



Loosen bolts.

Installation
tightening torque*



Press down on chain tensioner from above
and lock using Special foot 11 3 290.



Unscrew oil pressure pipe
Disconnect external plug.

* Refer to Specifications



Unscrew nuts

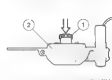
Installation
tightening torque*

Remove VAMCO control unit



Insert VAMCO control unit

Turn sprocket with mounted secondary
chain clockwise as far as stop



Push back control unit's spined shaft (1)
into housing (2) as far as stop



Check for loose sleeves (1).
Apply liquid sealant Three Bond 1309** on
both corners of separating plane between
cylinder head and VAMCO control unit.
Replace gasket.

* Refer to Specifications

** Source of Supply: 3M Part



Apply WANDS control unit and turn sprocket shaft (1) until the sprocket mesh.



Turn sprockets with mounted chain counterclockwise by hand far enough that the sprocket meshes in the splines of sprocket (2).

Important!

It is absolutely essential to ensure that the "FIRST" outside tooth meshes.



Move WANDS control unit in direction of the cylinder head.
Guiding the helical bevel sprocket chain to the helical bevel sprocket turns the sprockets with mounted chain counter clockwise.
Guide the chain with sprockets in counter clockwise direction by hand.



Tighten nuts.
Tightening torque*

* Refer to Specifications



Remove Special Tool 11 3 290

Uncover primary chain-tensioner (3)

Caution!

Spring force

Remove spring (2) and plunger (1)



Preload tensioning the chain with help of Special Tool 11 3 290 by tightening the lock screw to 1.3 Nm using Special Tool 11 3 290 or a standard torque wrench



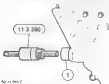
Tighten sprocket bolts of the exhaust cam shaft in two steps.
Tightening torque*

* Refer to Specifications

Remove special tool 11 3 240.



Remove special tool 11 3 290.



16 1 001 F

Install chain sensor plunger (1) in such a manner that the guide tube engage in the sensor pin.
Install spring (2) and bolt (3) together with a new seal.
Tightening torque 11 30 7A2*



16 1 001 F

Install plugs with new seals.
Tightening torque 01 30 3A2*



* Refer to Specifications



Check function of VAMOS control unit. Mount special tool 11 3 430 together with the oil pressure pipe coupling.
Connect up compressed air (2 - 3 bar)



Measure distance (10) between secondary sensor and edge on sensor gear. Note the measured distance.



Connect special tool 12 9 410 to the plug of the sensor for VAMOS. Connect positive clip to battery connection point.
Connect negative clip to vehicle ground to adjust the current.

Caution!
Reversing the terminals on the special tool will destroy the installed diode on the VAMOS control valve. The solenoid valve remains serviceable but current spikes can give rise to faults in the vehicle circuit.



Measure distance (2) between secondary reference and edge on sander gear. Note the measured distance.

Determine control travel:

- Distance 2
- Distance 1
- Control travel

The control travel must be at least 8.5 mm.

Important!

The control unit must be readjusted if the control travel is less than 8.5 mm.



Remove Special Tool 11 3 385.

Reassemble engine.



Remove Special Tools 11 3 450 and 12 6 410.



Mount oil pressure plate with new seals.
Tightening torque*
Connect oilfield plug.

* Refer to Specifications.



11-36 550 CHECKING REPLACING 4-WAY VALVE FOR VANDS

Switch off ignition.

The VANDS control unit plug is located behind the oil filter tied back on the engine wire harness.



Remove air guide for alternator. Disconnect plug.



Unscrew VANDS solenoid

Installation

Tightening torque*
Check seal, replacing it if necessary



Move the plunger back and forth to ensure that it moves easily



Move plunger of the hydraulic piston back and forth.
The hydraulic piston must be moved easily.
The complete VANDS control unit must be replaced if the hydraulic piston is hard to move.



* Refer to Specifications

11 Engine M51

00-02-249	BMW engine oil service (changing engine oil and oil filter)	11- 00/51 1
11-00-039	Compression – check	11- 00/51 2
060	Engine – remove and install	11- 00/51 3
	• Transmission – remove	11- 00/51 3
	• Radiator and inter-cooler – remove	11- 00/51 3
	• Remaining coolant from engine – drain	11- 00/51 3
	• Exhaust manifold with intake pipe – remove	11- 00/51 3
	• Vacuum lines – remove	11- 00/51 4
	• Electrical connections – disconnect from engine	11- 00/51 4
	• Fuel line – remove	11- 00/51 5
	• Water hoses – remove	11- 00/51 5
	• A/C compressor – remove	11- 00/51 6
	• Hydraulic pump for power steering – remove	11- 00/51 6
	• Engine – lift out	11- 00/51 7

For further jobs refer to "Assembly Repair Manual"

M21 engine

**01-00-249 BMW Engine oil service
(changing engine oil and oil
filter)**

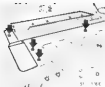
Refer to 01-00-248.

Repair Manual 3 Series E36

11 50 52* CHECKING COMPRESSION

Testing Conditions

Battery in perfect condition - check acid density if necessary
 Engine temperature a max. 35 °C coolant temperature



Unscrew cover for intake manifold



Unscrew support
 using holder

Caution!
 Don't touch electrical connections on the holder



Unscrew cover on electronic box



Pull out electric fuel pump relay (1) and plug on preheating time control unit (2)



Unscrew electric connections on glow plug



Unscrew glow plugs using Special Tool 12 2 160 (also refer to Group 12)

Precaution:
 Coat threads with copper paste CIP**
 (ignoring torque)



Detail Test Probe
 Screw in Special Tool 11 0 222 full distance and tighten, gently by hand.
 Compression Recorder.
 Plug in Special Tool 11 0 221.
 Operate starter so long until pressure stops rising.
 Minimum compression*
 Approximately same value for all cylinders

Use Special Tool 11 0 160.

* Refer to Specifications
 ** Source of Supply: BMW Parts

Engine M51 REMOVING AND INSTALLING Engine

a. Removing Transmission

Remove transmission - refer to Group 33 or 34.

b. Removing Radiator and Charge Air Cooler

Remove radiator and charge air cooler refer to Group 17.

c. Draining Residual Coolant from Engine

Unscrew and remove plug from engine block.
Drain coolant.

Installation
Replace seal.

d. Removing Intake Manifold with Intake Pipes

Unblock covers for intake flap test.

Unscrew supports
Unplug fasteners.



Unplug hoses from fasteners.

- 1 = Vacuum hose for brake booster
- 2 = Coolant hose to heater
- 3 = Fuel hose to injection pump



Pull vacuum hose off of EGR vacuum unit.



Pull temperature sensor plug off of intake manifold.

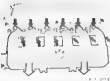


Unscrew EGR pipe.

Installation
Tightening torque*

* Refer to Specifications.

Unscrew intake manifold



Insulation
Regrate gas lines



Disconnecting Vacuum Pipes

Unclip vacuum pipe on brake booster



Pull GPR and radiator shutter control hoses off



Disconnecting Electric Leads from Engine

Lift cover for electric connections off of alternator
Disconnect leads from alternator



Unscrew leads from starter



Lift lead cover off of alternator
Unscrew connections



Unscrew connections for temperature sender and glow plugs



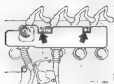
Disconnect speed sender plug



Pull plug off of oil pressure switch



Disconnect injection pump control plug and connections for shut-off and solenoid



Unscrew electric lead channel from engine



Unscrew ground strap from right camshaft



Disconnecting Fuel Pipe

Press retainer downwards and pull connection (3) out of filter housing

Insulation
Pay attention to seal.



Disconnect return pipe at injection pump



Disconnecting Water Hoses

Disconnect water hoses to heater on engine and on heater separating wall.

a Removing A/C Compressor

Loosen bolt and slacken multi-tooth belt

Installation

Turn tensioning roller counter-clockwise using a torque wrench applied to the hexagon socket

Tensioning procedures - refer to Group 84

Remove multi-tooth belt

Installation

Make sure that multi-tooth belt is placed precisely in groove

Unscrew A/C compressor from console and suspend from car on place of wire. Lines remain connected

Installation

Pay attention to correct sleeve



c Removing Power Steering Pump

Remove ribbed drive belt
Slacken the adjustment belt tensioner with a suitable lever (e.g. thick screwdriver) and remove ribbed drive belt

Important!

Pay attention to arrangement of belt
Place multi-tooth belt in grooves correctly

Hold pulley tight with help of ribbed drive belt
Unscrew bolts

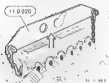
Unscrew bolts on top



5. Unscrew bolts on back.

Remove power steering pump and suspend from car on piece of wire. Lines remain connected.

11-00/51.7



6. Lifting Engine Out

Attach Special Tool 11-0-000 to engine.

11-00/51.7



Arrangement of suspension at front and rear.

Unscrew engine mount at right top and loosen nut at bottom.

Installation
Tighten up torque*

* Refer to Specifications



Unscrew engine mount at left top and loosen nut at bottom.

Installation
Tightening torque*

Lift engine out

Important!

A removed engine with installed hydraulic valve clearance compensators must not be left standing on its end for longer than 10 minutes, as otherwise oil would run out of the compensators so that they will no longer function.

* Refer to Specifications

11 Engine M60

11 00 050	Engine – remove and install	11- 00/60 1
11 12 004	Cylinder head covers, both – remove and install/seal	11- 12/60 1
	Cylinder head cover, left – remove	11- 12/60 1
	Cylinder head cover, right – remove	11- 12/60 2
005	Cylinder head cover, left – remove and install/seal	11- 12/60 5
006	Cylinder head cover right – remove and install/seal	11- 12/60 5
105	Cylinder head, left – remove and install	11- 12/60 5
106	Cylinder head, right – remove and install	11- 12/60 5
107	Cylinder heads, both – remove and install	11- 12/60 5
110	Cylinder head gasket, left – replace	11- 12/60 5
111	Cylinder head gasket, right – replace	11- 12/60 5
112	Cylinder head gaskets, both – replace	11- 12/60 5
11 13 010	Oil pan upper section – remove and install or replace	11- 13/60 1
020	Oil pan lower section – remove and install or replace	11- 13/60 4
11 14 080	Upper timing case cover left – remove and install, seal or replace	11- 14/60 1
085	Upper timing case cover, right – remove and install, seal or replace	11- 14/60 3
141	Radial oil seal in lower timing case cover – replace	11- 14/60 5
151	Crankshaft radial oil seal (transmission end) – replace	11- 14/60 6
11 22 500	Flywheel – remove and install or replace	11- 22/60 1
11 23 010	Vibration damper – remove and install or replace	11- 23/60 1
031	Hub for vibration damper – remove and install or replace	11- 23/60 2
11 28 010	Alternator drive belt – replace	11- 28/60 1
11 31 010	Camshaft timing – adjust	11- 31/60 1
011	Camshaft, left – replace	11- 31/60 1
015	Camshaft, right – replace	11- 31/60 1
11 41 000	Oil pump – remove and install or replace	11- 41/60 1
11 42 020	Full flow oil filter, complete – remove and install, seal or replace	11- 42/60 1
11 51 000	Water pump – remove and install or replace	11- 51/60 1
011	Pulley on water pump – replace	11- 51/60 2
11 53 000	Coolant thermostat – remove and install or replace	11- 53/60 1
325	Coolant manifold – remove and install or replace	11- 53/60 2
11 61 050	Intake air manifold – remove and install	11- 61/60 1
11 62 142	Exhaust manifolds, left both – remove and install or replace	11- 62/60 1
143	Exhaust manifolds, right both – remove and install or replace	11- 62/60 3

11 00 000 REMOVING AND INSTALLING (R&I)

Interrogas (air) memories

Disconnect battery ground lead
Remove manual clutch cable (refer to G1
T3) or automatic transmission (refer to G1
T4).
Remove radiator (refer to 12 11 000)



Unscrew left and right heel shields on front
axle carrier



Remove complete coolant expansion tank



Remove poly V-belt

Installation

Check poly V-belt for signs of wear and
oil, replacing it if necessary

Important

Always replace a poly V-belt drive with
hydraulic oil.



Unscrew tensioner for poly V-belt

Unscrew bolts (1) and (2)
Remove alternator (refer to 12 31 000)
Unscrew power steering pump (refer to
Group 30)
Pipes remain connected



Oil injection

Press holder for tensioner on hexagon (1)
up to the oil line (2)
Tighten nut (3)



Remove left and right engine mounts.
Remove ground strap from engine support
arm



Disconnect plug on oil level switch and
remove wiring guide



Remove upper section of air cleaner together with air mass meter



Remove complete throttle operating (Bowden) cable assembly at throttle body



Remove vacuum line at brake booster



Disconnect intake ventilation hose at throttle body



Remove right and left cylinder head cover
Disconnect plug-and-socket connections on right and left ignition coils

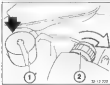


Disconnect cables from starter and alternator at battery (-) terminal point
Disconnect all plug-and-socket connections at cable duct on right
3 = TDC sensor
1 and 2 = knock sensors

Caution:
Interchanging plug-and-socket connections 1 and 2 causes engine damage!
Observe notes on knock sensors refer to 12 14 810



Disconnect air cables at right cable duct
1 = intake air temperature
2 = Throttle positionmeter
3 = idle actuator



Disconnect all cables at rear right cable duct
1 = limp-to-diagnosis socket from border
2 = plug-in plug connector



Unscrew common ground lead or ignition coils in area of rear engine mount (4).



Disconnect plug-and-socket connections of temperature sensors.

- 1 = Constant temperature sensor for remote thermometer (black)
- 2 = Constant temperature sensor for digital engine electronics control unit (white)



Disconnect all plug-and-socket connections at left cable duct.

- 1 = Bosch sensor
- 2 and 3 = Bosch sensors

Caution!

Interchanging plug-and-socket connections 2 and 3 causes engine damage!
Observe notes on Bosch sensors refer to 12 56 615



Disconnect plug-and-socket connection at air pressure switch.
Remove wire from holder



Disconnect all cables at front left cable duct.
Remove left and right cable duct from retaining fixture and fold back.



Caution!

Collect any fuel flowing out and dispose of suitably.
Disconnect fuel supply and return lines at injection valve.

Unscrew injection valve

Replace plastic hose



Disconnect air coolant hoses at coolant accumulator



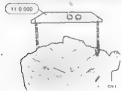
Caution!

Lift engine only at the lifting lugs provided for this purpose.
Location of front engine lifting points.

11-00/60.4



Arrangement of Rear Engine Suspension



Lift out engine using Special Tool 11-0-000
Clean engine



60 11 040 0

11 12 004 REMOVING AND INSTALLING SEALING BOTH CYLINDER HEAD COVERS

Left Cylinder Head Cover

Remove caps from collector, remove clips and unscrew sockets.



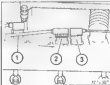
60 11 040 0

Remove cap from cylinder head cover, remove clips and unscrew sockets.



60 11 031 0

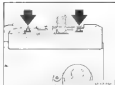
Disconnect plugs on ignition coils.



60 11 031 0

Disconnect all plugs on left-hand wiring duct
1 = Camshaft sender
2 and 3 = Knock sensors (refer to Gr 12)

Important!
Mixing up plugs 2 and 3 would lead to engine damage!
Also refer to information in Group 12!



Unscrew nuts of wiring shutters



60 11 004 0

Inspect all ignition coil nuts.

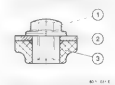
Insulation

Secure ground strap (1) to ignition coils of cylinders 3 and 7



60 11 029 0

Unscrew cylinder head cover screws.

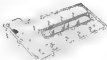


60 11 031 0

Insulation

Arrangement of cylinder head cover insulation

- 1 = Nut
- 2 = Washer
- 3 = Rubber mount



60-1104-1

Installation

Check gasket, replacing it if necessary

Deel outer and inner grooves as well as seating surfaces of cylinder head cover and cylinder head on around with rubber lubricant, e.g. glycerine or similar. Press inner gasket into cylinder head cover (leave free of distortion, beginning at the four corners).



60-1104-2



60-1104-3



60-1104-4

Installation

Align the outer gasket loosely on the cover groove

Locate gasket in the cover groove (beginning at the rear corner (left) (1) and press into groove free of tension.



60-1104-5

Right Cylinder Head Cover

Remove clips from collector, remove clips and unscrew screws

Remove cap from cylinder head cover, remove clips and unscrew screws

Disconnect plugs on ignition coils

Disconnect plug on oil level switch
Remove wiring guide



Disconnect all plugs on right-hand wiring duct.
1 and 2 = Knock sensors (refer to Gr 10)

Important:
Mixing up plugs 1 and 2 could lead to engine damage!
Also refer to Information in Group 10!

3 = TDC sender (pulse sender as vibration sender)



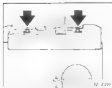
Disconnect plugs.
1 = Intake air temperature sensor
2 = Throttle valve potentiometer
3 = Idle speed control



Disconnect plugs.
1 = Diagnostic plug (unclip from holder)
2 = Engine plug



Close to Rear Engine Suspension Eye
1 = Temperature sensor for temperature gauge (black)
2 = Temperature sensor for Digital Motor Electronics (white)
3 = Ground lead of ignition coils



Unscrew nuts at wiring duct holders

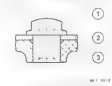


Unscrew nuts on all ignition coils

Important:
Secure ground strap (1) to ignition coils for cylinders 3 and 7



Unscrew cylinder head cover screws

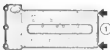


Installation arrangement of cylinder head cover installation:
1 = Nut
2 = Washer
3 = Rubber mount

**Installation note**

Check gasket and replace if necessary

Coat outer and inner grooves as well as sealing surface of cylinder head cover all round with rubber lubricant, e.g. glycerine or similar. Starting from the four corner points, evenly (i.e. without tension) press inner gasket into grooves in cylinder head cover.

**Installation note**

Align outer gasket on grooves in cylinder head cover. Starting at the rear corner side (R) the gasket is pressed in grooves in cylinder head cover and evenly pressed in free of tension.

**Installation note**

Coat joint areas of parting line with liquid sealing compound Hylomar SG 32 Special**

**Installation note**

Check gasket is fitted correctly. Tighten two nuts at opposite points without pre-tension. Align cover. Firmly tighten nuts crosswise working from inside to outside.

** Source of supply: BMW Parts Service

11 12 005 Removing and installing - sealing left cylinder head cover

This job is described under job instructions
11 12 004.

11 12 107 Removing and installing both cylinder heads

Remove engine, refer to 11 00 060
Further procedure, refer to 11 12 108-109
Repair Manual 7 Series E38

11 12 006 Removing and installing - sealing right cylinder head cover

This job is described under job instructions
11 12 004.

11 12 110 Replacing left cylinder head gasket

Refer to 11 12 105
Repair Manual 7 Series E38

11 12 105 Removing and installing left cylinder head

Refer to 11 12 106
Repair Manual 7 Series E38

11 12 111 Replacing right cyl nder head gasket

Refer to 11 12 106
Repair Manual 7 Series E38

11 12 108 Removing and installing right cylinder head

Refer to 11 12 106
Repair Manual 7 Series E38

11 12 112 Replacing both cylinder head gaskets

Remove engine, refer to 11 00 060
Further procedure, refer to 11 12 105-106
Repair Manual 7 Series E38



11-13-015 REMOVING AND INSTALLING OR REPLACING UPPER SECTION OF OIL PAN

Remove caps from collector



Remove caps on radiator from above



Unthread pins using Special Tools 11-3-040 and 11-3-050



Unscrew connector on dipstick guide tube
Installation
Tightening torque*

* Refer to Specifications



Installation
Replace O-ring



Remove rear engine splash guard (not 1300s)



Remove complete lower section of oil pan - refer to 11-13-020



Unscrew bolts of left and right engine mounts at bottom.

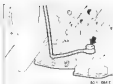
Installation
Secure ground strap on engine mount
Tightening torque*

* Refer to Specifications

Unscrew power steering pump at holder
Unscrew oil pipes for automatic transmission at power steering pump



Put
1. Insert oil pipe and
2. pure oil pipe
out of crankcase

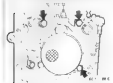


Unscrew oil return pipe from oil filter at oil pan



Unscrew sprocket belt
Remove sprocket together with chain.

Installation
Tightening torque*



Unscrew oil pump bolts
Remove oil pump

Installation
Tightening torque*

* Refer to Specifications



Installation
Check seal, replacing it if necessary
Lubricate seal lightly with oil.
Inspection
Don't damage seal on edge of the case.



Installation
Insert pure oil pipe if necessary.
Check seal, replacing it if necessary



Installation
Check seal in oil pump, replacing it if necessary



Installation
Screw hexagon adapter back into oil pump as far as it will go.



Attach Spectral Tool 00 0 000 to front engine suspension eye and lift engine.

Caution!
Observe distance between engine and fire wall while lifting the engine.



Installation
Mount oil pump and tighten bolts (1 and 2).

Installation
Clean upper section of oil pan and seating surfaces.
Replace gasket.



Installation
Mount sprocket together with chain and tighten central nut.



Installation
Adjust chain sag (10 or 2 mm) by turning hexagon adapter in oil pump.
Install and tighten bolt.
Tightening torque*

* Refer to Specifications



60-11-160-1

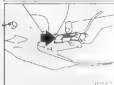
11-13/60.4 REMOVING AND INSTALLING OR REPLACING LOWER SEC- TION OF OIL PAN

Unscrew cover for oil filter to have the
engine oil run back into the oil pan.
Drain engine oil.



60-11-160-2

Unscrew from engine splash guard



60-11-160-3

Disconnect oil level switch plug
Unscrew screws

Inspection
Replace O-ring
"Tightening torque"



60-11-160-4

Unscrew bolts for lower section of oil pan

Inspection
Clean seating surfaces.
Replace gasket
"Tightening torque"

* Refer to Specifications

11 14 000 REMOVING AND INSTALLING OR REPLACING LEFT UPPER TIMING CASE COVER

Remove left cylinder head cover - refer to
11 13 000.

Remove alternator - refer to 12 31 000.

Uncrew cover of oil filter

Uncrew return pipe at oil filter housing

Important
Tightening torque*

Uncrew left flow oil filter housing nuts

Important
Tightening torque*

* Refer to Specifications

Uncrew battery positive wire on alternator
Uncrew protective tube mounting screws.
Place wire aside.

Uncrew timing case cover bolts

Important
Tightening torque*

Important
Check for correct seating of dowel sleeves
(1).
Coat centers of joint surfaces between cy-
linder head and cylinder head gasket with
diesel engine compound SD 32 Special**

Important
Clean seating surfaces to remove oil.
Replace gasket

Important
Pull oil protective sheet

* Refer to Specifications
** Source of Supply (BMW Parts)



Installation

Check for correct seating of gaskets.
Mount timing case cover together with
lubricated bolt.

Important!

Bolt cannot be guided in subsequently.



Installation

Insert all bolts.

Screw in bolts (1) until cover contacts
cylinder head free of play, but do not yet
tighten bolts.



Installation

Tighten timing case cover bolts (2) in two
steps and then tighten bolts (1) in two
steps.

Tightening torque*

* Refer to Specifications

**11 14 005 REMOVING AND INSTALLING
OR REPLACING RIGHT UPPER
CAM CASE COVER**

Remove right cylinder head cover - refer to
11 12 006.



Remove air cleaner upper section together
with hose on flow screw.



Unscrew screw for air dipstick guide tube



Unscrew nut
Replace O-ring

Remove O-ring separator

Installation
Replace gasket
Tightening torque*



Unscrew timing belt cover bolts



Unscrew camshaft sensor screw



Installation
Clean sealing surfaces.
Remove protective sheet or gaskets*

* Refer to Specifications



Important:

Replace seal of oil supply for hydraulic tensioning elements on timing case cover.
Only use original BMW parts for replacements.



Installation:

Check for correct seating of dowel sleeves (1).
Coat corners of joint surfaces between flywheel head and cylinder head gasket with liquid sealant Hytomer 50 for Special*.



Installation:

Check for correct seating of gaskets.
Press tensioning belt upwards firmly.
Mount timing case cover.
Install all bolts.

Screw in bolts (1) until cover contacts cylinder head face of flywheel but do not yet tighten bolts.



Installation:

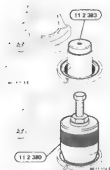
Tighten timing case cover bolts (2) in two steps and then tighten bolts (1) in two steps.
Tightening torque*

* Refer to Specifications

** Source of Supply: BMW Parts

11 14 145 REPLACING Radial Oil Seal IN LOWER TIMING CASE COVER

Remove hub for vibration damper refer to
11 23 035



Push out radial oil seal using Special Tool
11 2 380 contains Special Tool 11 2 380;



Installation
Install radial oil seal in timing case cover
Push using Special Tool 11 2 380 and
central bolt

11 14 151 Replacing radial seal on Crankshaft (transmission end)

Removing flywheel, see 11 22 000



60 11 151



60 11 151

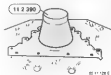


60 11 230

Removing part of the oil pan screws



Installation instruction:
Clean sealing face and replace gasket.
Check that bushes are correctly located.



60 11 230

Installation instruction:
Fit special tool 11 2 280 on crankshaft.
Coat sealing lip of radial seal with oil.
Slide on cover and tighten down.

Rear and cover: tighten screws

Installation instruction:
Drive radial seal into end cover using special tools 50 5 500 and 11 1 230.

11 22 500 Removing and installing or replacing flywheel

(Remove clutch)

Block flywheel with special tool 11 2 070



MM6 3 0: Use up to 11 90

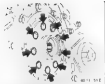


Caution!
Release and tighten flywheel (steel mass flywheel) only with special tool 11 3 380
For tightening torque, refer to Technical Data 11 22 542

At MM6 4 0: Use and MM6 3 0: Use after 11 93



Caution!
Release and tighten flywheel (steel mass flywheel) only with special tool 11 4 180
For tightening torque, refer to Technical Data 11 22 542



Installation note
Clean thread for flywheel bolts in crankshaft



Installation note
The flywheel (2460) has a special (shorter) fitted sleeve

Caution
Replace only by original BMW spare part

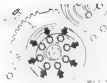


Installation note
The position of the fitted sleeve (1) at the steel mass flywheel is marked by two notches, not at the bolt hole



Caution
Flywheel bolts are a component part of the flywheel.
Do not fit flywheel bolts with bolt sealing compound.
Lightly oil thread of bolts.
Only tighten to specified tightening torque.
Overtightened flywheel bolts can cause the special tool to break during subsequent disassembly.

11 23 010 Removing and installing or replacing vibration damper



Release vibration damper bolts.



Caution!
Left-hand thread
Remove fan, use special tools 11 2 050 and
11 2 050 for this purpose.



Installation note
Align fitted hole in vibration damper with fitted
locating pin
Fit vibration damper bolts.

For tightening torque
refer to Technical Data 11 23 342

Remove drive belt for alternator
refer to 11 26 010



Release pulley on water pump.
Hold water pump pulley with drive belt and
release screws.

11 23 031 Removing and installing or replacing hub for vibration damper

Remove vibration damper refer to 11 23 018

Installation note

Fit special tool 11 2 480 or special tool 11 2 486. Special tool 11 2 486 is magnetic



Fig. 1

Remove protective plate at front

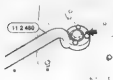


Fig. 2

Select 3 position and mark on axle.
Tighten central bolt with joint torque
and tightening angle.
For tightening torque
refer to Technical Data 11 23 082

Remove cooling air duct for alternator at
original mount

Observe fitted locating pin
Secure special tool 11 2 480 to hub for vibration
damper
Release central bolt





11 28 025 REPLACING DRIVE BELT from ALTERNATOR

Remove caps from collector and clips.
Unscrew screws



Disconnect brake hose between master valve assembly and master air line sensor



Unscrew fastening bolts: Tools 11 5 040 and 11 5 030



Remove ribbed drive belt
Note arrangement of ribbed belt drive

Inspection
Check ribbed drive belt for traces of coolant and oil, replacing it if necessary

Important!
Always replace ribbed drive belt if it is drilled with hydraulic oil



Loosen nuts (1) and (2) to slacken the drive belt



Inspection
Install ribbed drive belt and check for correct fit on the pulleys.
Preload the adjusting plate up to the end of belt (2) by turning hexagon (1) 1/2 turn nuts (2)



Unscrew nuts (1) and belt (2)
Remove complete belt tensioner

11 31 010 Adjusting camshaft timing

Refer to 11 31 010

Repair Manual 7 Series E 20

11 31 011 Replacing left camshaft

(Intake or exhaust valve as required)
(cylinder row 1-4)

Refer to 11 31 011

Repair Manual 7 Series E 20

11 31 012 Replacing right camshaft

(Intake or exhaust valve as required)
(cylinder row 1-4)

Refer to 11 31 012

Repair Manual 7 Series E 20

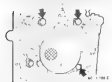


11-41-000 REMOVING AND INSTALLING
ON REPLACEMENT OIL PUMP

Remove complete oil pan lower section
refer to 11-13-000
Unscrew sprocket bolts

Installation
Tightening torque*

Remove sprocket together with chain



Unscrew oil pump bolts

Installation
Tightening torque*

Remove oil pump



Pull
1 - unlubricated oil pipe and
2 - pure oil pipe
out of crankcase



Installation
Check seal, replacing it if necessary
Lubricate seal lightly with oil

Important!
Ensure that seal is not damaged on edge
of case

* Refer to Specifications



Important!
Install pump on pipe in crankcase
Check seal, replacing it if necessary



Installation
Check seal in oil pump, replacing it if
necessary



Installation
Turn back hexagon adapter into oil pump
as far as stop



Installation
Mount oil pump and tighten bolts (hand 2).
Tightening torque*

* Refer to Specifications



Installation

Mount sprocket together with chain and a chain derailleur.
Tightening torque*



Adjustment

Adjust chain sag, 50-90 mm by turning tension adapter in the pump head and tighten bolt.
Tightening torque*



60-11-004-1

11-42-006 REMOVING AND INSTALLING SEALING OR REPLACING FULL FLOW OIL FILTER

Remove alternator refer to 12-31-006.
Disconnect oil hoses at center
Use the bolt (1)
Lift out hoses upwards

Installation
Check seals, replacing them if necessary
Check arrangement of oil hoses
1 Used on
2 Used on
3 Put on



60-11-004-2

Unscrew belt and nuts
Remove oil filter

Installation
Tightening torque*



60-11-004-3

Installation
Screw back adjusting hexagon into oil filter
as far as possible using a hexagon socket
key



60-11-004-4

Unscrew oil drain pipe at oil filter

Installation
Check seal, replacing it if necessary
Tightening torque*



60-11-004-5

Installation
Mount on upper timing case cover with
both nuts



60-11-004-6

Unscrew oil drain pipe at oil pan

Installation
Check seal, replacing it if necessary
Tightening torque*



60-11-004-7

Installation
Turn adjusting hexagon with help of hexa-
gon socket key until there is contact on the
alternator free of play, but "do not preload"

11-42/60.2



INSTALLATION

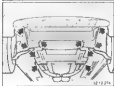
Insert bolts and tighten both end bolts nuts.
Tightening torque*

* Refer to Specifications



**11 51 600 REMOVING AND INSTALLING
OR REPLACING WATER PUMP**

Unscrew heat shields at left and right hand
sides of front axle carrier



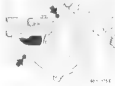
Unscrew front and rear engine splash
guards

Open coolant, refer to Group 17
Remove vibration damper, refer to
11 52 070

Disconnect coolant hose at cover of
thermostat housing
Remove thermostat housing cover together
with thermostat
Disconnect coolant hose at thermostat
housing



Unscrew bolts and remove water pump



Installation
Check for correct seating of cover screws
Clean seating surfaces
Replace gasket



Hold water pump pulley tight with help of
rope drive belt and unscrew bolts

Installation
Tightening torque*

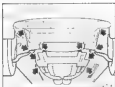
* Refer to Specifications

11 51 011 Replacing pulley on water pump

Remove drive belt for alternator
refer to 11 25 010



Hold water pump pulley with drive belt and
release screws



11 53 600 REMOVED AND INSTALLING OR REPLACING COOLANT IN(RAD)TAT

Remove front engine splash guard



Remove air cleaner upper section together
with mass air flow sensor

Disconnect coolant hose at cover of ther-
mostat housing
Unscrew bolts of thermostat housing cover
Remove thermostat housing together with
bolts.

Installation
Tightening torque:

Replace gasket
If it cooling system - refer to Group 17
Bleed and check cooling system for leaks
refer to Group 17



11 53 375 REMOVING AND INSTALLING ON REPLACING COOLANT COLLECTOR

Remove caps from collector and clips.
Loosen bolts.



Remove front and, if applicable, rear
engine splash guards.



Unscrew heat shields at left and right hand
sides of front engine carrier.



Drain coolant - refer to Group 17
Remove complete cone to expansion tank



Place coolant expansion tank aside.



Disconnect plug of wiring on back of right
wiring duct.



Unclip diagnostic socket (1) in holder
Blackhawk engine plug (2).



Loosen all coolant hoses at coolant
collector.
Unscrew coolant collector screws on back
of cylinder head at left and right hand sides.
Installation
1 tightening torque

Refer to Specifications



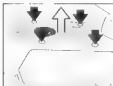
Unscrew coolant collector bolts

Installation
Tightening torque*



Unscrew coolant collector bolts

Installation
Check seal ring surfaces
Replace gaskets
Tightening torque*



11 61 030 Removing and installing intake manifold

Check defect code memory
Switch off ignition
Unclip screw caps on covering for cylinder head cover
Release screws
Remove covering for cylinder head cover



Remove hose clips at idle actuator and throttle body



Release plug-and-socket connection on air mass meter



Release clips
Remove upper section of air cleaner together with air mass meter



Pinch screw caps
Release screws
Remove covering for right cylinder head cover



Jack up vehicle
Disconnect plug-and-socket connection at oil level switch



Disconnect plug and socket connections at ignition coils



Disconnect plug-and-socket connections
1 Knock sensor cylinders 3 and 4
2 Knock sensor cylinders 1 and 2
3 Pulse generator (on vibration damper)

Caution!
Interchanging the plug-and-socket connections 1 and 2 causes engine damage!
Observe notes on knock sensors, refer to 12 14 6 10



Disconnect plugs.

1. Intake air temperature sensor
2. Throttle valve position sensor
3. Idle speed control



Disconnect plugs.

1. Diagnostic plug (junction in holder)
2. Engine plug



Unscrew nut on ground wire of ignition coils (3) close to rear engine suspension eye off.



Disconnect plugs of temperature sensors.

1. Temperature sensor (black) for temperature gage
2. Temperature sensor (white) for digital engine electronics (DME)



Unscrew screws of holder (1) for collector cover.



Disconnect throttle cable.

Compress ripple mounts on both rearward and press out of operating lever.



Press ripple out of ripple mounts. Take cable out of ripple mounts.



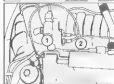
Take cable (2) out of rubber mount (1). Take rubber mount (1) out of holder. Remove throttle cable.



Remove covering for left cylinder head cover (cylinder row 5-6).



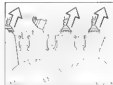
Remove throttle operating (Bowden) cable from holder (1).



For cruise control (optional):
Run temporary operating cable (1) under throttle operating cable (2).



Arrangement of temporary operating cable on cylinder head cover



Disconnect plug-and-socket connections of ignition coils.



Disconnect plug-and-socket connections:
1. Camshaft sensor
2. Knock sensor cylinders 5 and 6
3. Knock sensor cylinders 7 and 8

Caution!
Interchanging plug-and-socket connections 2 and 3 causes engine damage.
Observe notes on knock sensors refer to 12 54 611



Disconnect plug-and-socket connection (1).
Disconnect overflow hose (2).
Release screws on left and right and place expansion tank to side



Coolant expansion tank



Disconnect plug-and-socket connector at oil pressure switch.



Disconnect wire of oil pressure switch.



Remove screw fittings of cable ducts on cylinder heads.



Remove vacuum hoses at radiator.
Release hose clip.



1 Tank ventilation
2 Vacuum supply for brake booster



Disconnect vacuum hoses at brake booster



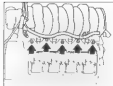
Disconnect tank ventilation hoses at engine body



Remove fuel supply and return lines in insulation note.
Replace plastic hoses



Disconnect hose (1) from end cover (2) on rear of manifold



Release bolts on right and left
Remove manifold by pulling upward



Note
Version 1
Ventilation pipe fitted
Release screws

Caution
Pull end cover for pressure control valve
straight back to ensure ventilation pipe (1) is
not damaged



Installation note
Check sealing ring and gasket, replace if
necessary



Note
Version 3
Ventilation pipe and end cover connected with
clip.
Remove clip and pull engine ventilation pipe
forward.

Installation note
Check seal, replace if necessary

Read out defect code memory
Check, stored (deleted) codes
Repair defect, delete defect code memory

11 62 142 REMOVING AND INSTALLING ON REPLACING BOTH LEFT EXHAUST MANIFOLDS

Remove exhaust assembly - refer to Gr 18
Remove alternator - refer to Group 12
Remove left cylinder head cover - refer to
11 12 005.



If applicable, unscrew bolts of center of
gravity mount to front axle carrier.
Unscrew left rear shields on front axle
carrier.



Remove complete air cleaner upper section
together with mass air flow sensor.



Unscrew bolts of left and right engine
mounts at bottom.

Installation
Tightening torque*



If applicable, remove rear engine splash
guard.



Installation
Left and front engine using Special Tool
93 0 290 attached at front eye.

Important!
Ensure clearance between engine and the
right.



Check for correct installation position of
manifold.

* Refer to Specifications.

42 1 11 2

* Refer to Specifications.



Installation
 Replace gasket.
 Tighten bolts to exhaust manifold.



11-62-142 REMOVING AND INSTALLING ON REAR, ACROSS BOTH RIGHT EXHAUST MANIFOLDS

Remove exhaust assembly (after 10-60-16)

Remove manifolds upwards

Important

Remove manifold for cylinders 3-4 first!



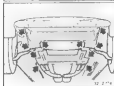
Remove right rear shields on front axle
carrier at left and right hand sides



Important

Replace gaskets

Get in both face exhaust manifold!



If applicable, remove rear engine splash
guard.

Remove existing fluid leak
inspect manifold ports.

Attention

Tightening torque*

* Refer to Specifications

12 Engine electrical system

Notes on ignition system, DME (Digital Motor Electronics) and engine electrical equipment	12-	0/1
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111 Distributor rotor – replace	12-	11/2
12 12 011 Spark plugs – replace	12-	12/1
072 Spark plug connector – replace one	12-	12/2
12 13 009 Ignition coil (M20, M30, M40) – check	12-	13/1
009 Ignition coil (M50, M60) – check	12-	13/1
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011 Ignition coil (M50) – replace	12-	13/11
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150 Cylinder reference sensor (S38 B38) – replace	12-	14/2
150 Cylinder reference sensor (camshaft sensor M50) – replace	12-	14/2
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12 21 500 Relay for glow plugs – remove and install or replace	12-	21/1
12 23 000 Glow plugs: all – check	12-	23/1
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020 Alternator (M51) – remove and install – replace	12-	31/4
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299 Alternator drive belt (M20, M30, M40) – check/tension	12-	31/8
Alternator pulley – replace	12-	31/10
12 32 000 Voltage regulator – replace	12-	32/1
12 41 020 Starter (M20, M21, M30, S38) – remove and install	12-	41/1
020 Starter (M40) – remove and install or replace	12-	41/2
020 Starter (M50) – remove and install	12-	41/3
020 Starter (M51) – remove and install or replace	12-	41/4
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12 64 005 Fuel heater – replace	12-	64/1
12 70 500 Safety path of electronic engine power control (EML) – check	12-	70/1
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For M43 engine refer to "Repair Manual 3 Series E36"

INSTRUCTIONS FOR WORKING ON IGNITION SYSTEM, DME (DIGITAL MOTOR ELECTRONICS), THROTTLES, AND ENGINE ELECTRICAL EQUIPMENT

Precautions:

- Always switch off ignition before working on ignition system. Never touch component under voltage while engine is running. **Dangerous high voltage!**
- Always remove DME master relay for the compression test to avoid activation of ignition coils by ignition final stages of the DME control unit. **Dangerous high tension!**
- Always switch off ignition before connecting, disconnecting Service Tester, other testers and adapters or replacing components!
- Secondary (high tension) side of ignition system must be loaded with at least 4 lighting.
- Never start engine after removing distributor cap or if disconnected wiring from battery on ignition coil (even not lit).
- Never connect a switched capacitor or test lamp on ignition coil terminal 1.
- Never connect ignition coil terminal 1 wire to ground or B+. Consequently terminal 1 wire may not be used to replace starting when service installing a burglar alarm system.

Direct Ignition System (Without Distributor)

- Engine must never be started after disconnection of the secondary circuit, i.e. the connection of connectors on spark plugs and ground connection terminal 4a.
- There is **dangerous high tension** in or on ignition leads, spark plug connectors, spark plugs. Ignition coil terminal 4 (Caution: approx. 40 kV high tension) and terminal 1 wire from ignition coil to DME control unit (Caution: approx. 300 V high tension at terminal 1).
- Battery as well as wiring on alternator and starter may not be disconnected on a running engine.

Disconnecting Battery

Important!

Disconnecting the car battery will erase the fault memories of control units. Consequently always interrogate fault memories and have faults cleared with help of a BMW Service Tester before disconnecting the battery.

Investigate stored faults

The radio can only be operated after disconnection of the battery by entering the radio code again, so that the customer should first be asked for his radio code card. Note stored faults so that they can be stored again after connection of the battery. The stored data of the on-board computer and clock will also be lost if car is fitted with an infrared locking system, all keys must be recorded. Refer to Car Radio Electronic First Aid for additional information.

INSTRUCTIONS FOR REMOVING AND INSTALLING ELECTRONIC CONTROL UNITS

Ignition must always be switched off before disconnecting or connecting control unit plugs.

Removal and installation of components, e.g. plugs, hoses, etc., could delete the storage of faults in fault memories of control units capable of self-diagnosis. Consequently fault memory must always be interrogated after working on the electrical system.

Stored faults must be investigated and cancelled.

How When Replacing DME (Digital Motor Electronics) Control Unit

Each control unit is programmed with certain basic values, which serve as mean values. The control unit requires different input values depending on engine condition, which are compared with the stored values.

The adaptive system compares the input values with the stored map values.

Appropriate correction commands are sent to the concerned drive elements (for example, the DME control unit would be without current for a long time (days than one hour). Its adaptive system would take the stored values.

After re-operation of a concerned or malfunctioned or new control unit the input values of a particular engine must be read in and stored for the adaptive system. This procedure could lead to initial idling and disturbed overrunning of the engine after starting.

Depending on the plug it could require some time before all values are adapted to the engine condition.

Consequently there must be compliance with the following procedures before replacing a DME control unit or operating a control unit which had been disconnected:

• replace control unit and drive for at least 5 minutes while changing the engine speed

• interrogate fault memories and have faults cleared with help of a BMW Service Tester (investigate stored faults)

CHECKING COMPONENTS

Note

Refer to Construction Group Repair Manual.

Always operate with safety precautions and accident prevention regulations whenever carrying out tests or work on engine electrical and electronic components.

Always disconnect plugs or control units or components before checking electric wires.

Testing Aids

Connection wiring diagrams and current flow diagrams can be found in the binders for "Car Electric/Electronic Test Plan - 3 Series E 33".

Only use appropriate test leads. Adapter leads refer to concerned repairing instructions, terminals and test tips.

Test values for checking components are contained in the Car Electric/Electronic Test Plan.

Also refer to the Technical Data section for other specifications.

OUTSIDE STARTING AID

Do not start the engine with help of starting sprays.

Preparations

Conform with the following when starting engine with starting cable.

1. Ensure that starting cable wires are of appropriate cross section size.

2. Only use fuse-protected starting cables.

3. Check whether the current supplying battery has 12 V voltage.

4. If engine is started from battery of another car, ensure that there is no contact between the bodies of both cars.

Caution

Never touch ignition system components under current - dangerous high tension!

Procedures

Always conform with the procedures to avoid injury to persons or damage to parts.

Select range P on cars with an automatic transmission and apply the parking brake.

Move the shift lever of cars with the fuel transmission into neutral and apply the parking brake.

Ensure that the starting cables cannot get caught in rotating parts, e.g. fan.

First connect both positive poles of the batteries with one starting cable (red).

Use the positive connection point in the engine compartment for cars with the battery in the trunk.

Then connect the second starting cable (black) between the negative pole of the current supplying battery and engine or body ground of the car to be started.

Caution

Never connect the second starting cable (black) on the negative pole of the battery in the car to be started. Produced gas could be ignited by sparks up - danger of explosion!

If the battery in the car supplying power is weak, start the engine of this car and let it run at idling speed.

After the engine of the car to be started has started up, first disconnect the starting cable on the negative pole - ground connection. Then remove the starting cable from the positive poles.

OUTSIDE STARTING AIR AND CAR TELEPHONE

Siemens C 3

When starting the engine with help of the battery, a different vehicle ensures that the Siemens C 3 telephone is not damaged through overvoltage.

Disconnect the sender and receiver from the electrical system prior to starting the engine with outside help.

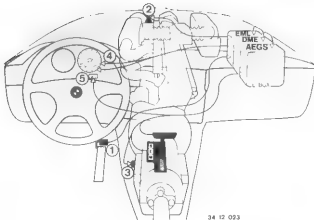
Siemens C 3 and Motorola C 451

Senders and Receivers of Siemens C 3 and Motorola C 451 car telephones have over voltage protection, but calls may not be made while starting the engine with outside help.

Always refer to the pertinent operating instructions of other type and other make car telephones.

If in doubt, disconnect the sender/receiver from the electrical system.

DME SURVEY



34 12 023

- 1 Pedal valve sender
- 2 Throttle valve drive motor
- 3 Bayonet connector for transmission control
- 4 Speed signal/consumption display
- 5 Program display

DME

DME

AEGS

S

E

M

- Electronic engine power control
- Digital meter electronics
- Independent electronic transmission control
- Sport
- Economy
- Manual

12-0/4



Troubleshooting engine electric/electronic system since introduction of M 1.1 - see electric/electronic test plan.

Can be recognized on the increment wheel (1) for sender-type Motronics.

12-11/1



12-11-000



12-12-100

12-11-001 REPLACING DISTRIBUTOR CAP

Take off cover

Installation
Engage cover in holder

Pull off shielded plug connector

Installation
Numbering of electric leads and cap (e.g. 1) must be identical.
ZS = Ignition coil
Applicable for M 20 and M 30 engines.

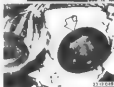
App.
M 20 / M 30 1 - 5 - 3 - 6 - 2 - 4



12-11-000



12-12-100



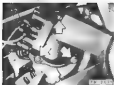
12-12-100

Unscrew fan - left-hand threads!
Use Special Tools 11-6-030 - 040.
Unscrew and push up fan cover.

Unscrew bolts and take off distributor

Caution
Danger of cutting hands on radiator
!!!

WARNING
Check seal, replacing if necessary



12 11 111 REPLACING DISTRIBUTOR ROTOR

Remove distributor cap – see 12 11 094

Caution:
Danger of cutting hands on rotor
0000



Unscrew screws with a 3 mm socket head key

Installation
Tightening torque*



Testing
Measure resistance*
Inspect surface and cast compound for cracks and traces of burning.

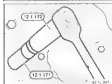
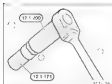
12-12/011 REPLACING SPARK PLUGS

M20 - M30

Remove spark plug connections.
Unscrew spark plugs using standard plug wrench.

Installation

Tighten spark plugs using plug wrench
and Special Tool 12-1-200.
Refer to tightening torque when working
without Special Tool 12-1-200.



Remove spark plug connections.
Unscrew spark plugs using Special Tool
12-1-171.

Installation

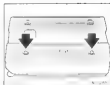
Tighten spark plugs using Special Tools 12-1-171 and 12-1-200.
Refer to tightening torque* when working
without Special Tool 12-1-200.



Remove spark plug connections.
Unscrew spark plugs using Special Tool
12-1-171.

Installation

Tighten spark plugs using Special Tools 12-1-171 and 12-1-172.
Refer to tightening torque* when working
without Special Tool 12-1-172.

**M50 - M60**

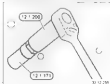
Unscrew cover on cylinder head cover.



Unscrew ignition coils.

**Precaution**

Ground straps of cylinder head cover must be secured on ignition coils of cylinders 1 and 6.
Tightening torque*



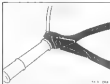
Unscrew spark plugs using Special Tool
12-1-171.

Installation

Tighten spark plugs using Special Tools 12-1-171 and 12-1-200.
Refer to tightening torque* when working
without Special Tool 12-1-200.

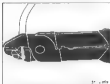
* Refer to Specifications

* Refer to Specifications



12 12 072 REPLACING ONE SPARK PLUG CONNECTOR

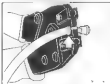
Cut off ignition lead close to the connector



Strip ignition lead 6mm (5/16") with a stripping pliers* (1.5 mm x 0.050" lead)



Place coupling on ignition lead and squeeze on wire and frt with Special Tool 12 1 050/051



Place connector flush with pliers and squeeze on.



Place ignition lead in Special Tool 12 1 050 and slide into spark plug connector until the coupling is heard to engage.
If applicable, spray with lubricant (Special Tool 12 1 050).

* Source of Supply: HWH

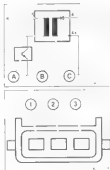
12-13-008 CHECKING IGNITION COIL (M20, M30, M40)

Multimeter Test (M20)

Measure resistance of primary coil between terminals 1 and 15 = 0.5 k Ω \pm 10 %
and resistance of secondary coil between terminals 15 and 4 = 8 k Ω \pm 10 %.



Check the cast compound of the primary coil carrier for hairline cracks. If gray material has run out at the edges of the coil carrier, this is indication for a faulty Ignition Final stage in the DME control unit.



12-13-008 CHECKING IGNITION COIL (M20, M30)

Refer to precautions on page 12-5.1

Wiring Diagram of Ignition Coil in Direct Ignition System

- A Primary coil activation of Ignition coils by DME
- B Ignition coil
- C Secondary coil ground connection

Ignition Coil Plug Pin Connections

- 1 Terminal 15
- 2 Terminal 1a
- 3 Terminal 1

Resistance Test

Primary coil specification = 0.4 - 0.8 k Ω
Resistance of the secondary coil cannot be measured

Check the cast compound of the primary coil carrier for hairline cracks.

If gray material has run out at the edges of the coil carrier, this is indication for a faulty Ignition Final stage in the DME control unit.



12-13 CHUCKING SECONDARY VOLTAGE USING TEST ADAPTER KIT 12-1-045

The following tests can be carried out with the adapter kit:
 Secondary voltage test
 Different make ignition coil comparison
 Ignition coil faults
 Spark plug faults
 Injection system faults

Caution
 Refer to precautions on page 12-5.



Special Tool 12-1-042 for BMW Service Tester.
 The ignition tension clip must be disconnected from the service tester lead for connection to the Service Tester.

If a BMW Service Tester is not available, a common edgewise coil/oscilloscope with test leads may be used.
 Special Tool 12-1-042 is then replaced by a test lead of the oscilloscope.
 *Triggering is then accomplished externally via the induction clip with primary voltage coming from cylinder no. 1.



Connect Special Tool 12-1-042 to Special Tools 12-1-041 and Special Tool 12-1-042 for the BMW Service Tester.

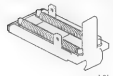
Connecting Lead 12-1-042



M 50

Refer to precautions on page 12-5:
 Switch off ignition.
 Unscrew ignition coil cover.

Firing order = 1-5-3-6-4-2



Special Tool 12-1-041 for installation on the ignition coil



Mount Special Tool 12-1-041 on ignition coil and connect using Special Tool 12-1-042.

**Notes**

Refer to printed info on page 10-51
Switch off ignition
Unscrew ignition coil cover

Fitting order: 1-5-4-3-6-2-7-8



Mount Special Tool 12-7 042 on ignition coils and connect using Special Tool 12-7 043

**Note**

Use the long connecting lead of Special Tool 12-7 042 for connection of adapters between cylinder banks 1 - 4 and 5 - 8



Connect BMW Service Tester as follows

Unscrew high tension clip from the connecting lead of the BMW Service Tester. Connect Special Tool 12-7 042 to the high tension connecting lead of the BMW Service Tester



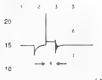
Connect BMW Service Tester to diagnose engine (1) in the car
Connect Special Tool 12-7 042 (2) to high tension connecting lead (3) of the BMW Service Tester
Connect trigger clip (4) of the BMW Service Tester to power supply lead of the ignition coil for cylinder no. 1

BMW Service Tester
Select Test Step 01 (engine) and afterwards select Test Step 10 (mixture exhaust)

Enter the number of cylinders

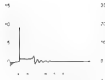
Apply the parking brake and move the manual transmission shift lever to neutral or the automatic transmission selector lever to "N"

Select the type of display of secondary voltage on the oscilloscope with key "B"
Display of voltage (parallel, in series, superposed)



NORMAL OSCILLOGRAPH

- 1 Beginning of ignition voltage peak
- 2 Ignition voltage peak
- 3 Spark ng voltage peak
- 4 Spark ng period
- 5 Spark ng voltage line
- 6 Beginning of dying-out process
- 7 Dying-out



Serial display firing series

Greater differences can be recognized in the ignition voltage displays. Allocation of a recognized fault to a particular cylinder must be made with help of the type of display (4 series parameter)

Parallel display
Evaluation of sparking voltage line and dying-out process firing speed.

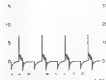


The display of ignition voltage peaks is about 10 to 15 % lower than the setup value

The uniformity of all cylinders to each other is more important than the height of ignition voltage peaks

Differences of 2000 to 4000 V are acceptable

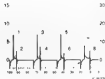
Refer to "fault displays" on the following pages in case of greater differences



Display with speed increased to approx 2000 rpm.
Evaluation of ignition voltage peaks.

OSCILLOGRAPH FROM DIFFERENT MAKE IGNITION COILS

Evaluation of ignition voltage peaks and dying-out process at idling speed



Make: Borel

- 1 Normal ignition voltage peak (5000 to 5000 V)
- 2 Normal

Make: Borel

- 3 Normal ignition voltage peak
- 4 Higher beginning of dying-out process

Make: May & Christie

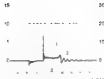
- 5 Normal ignition voltage peak
- 6 Lower beginning of dying-out process

Make: Bosch

- 7 Lower ignition voltage peak
- 8 Normal beginning of dying-out process

Note

As compared with other makes of ignition coils the ignition voltage peaks will be shortened very strongly at higher speeds



Evaluation of sparking voltage peaks at engine speed increased to approx. 1000 rpm

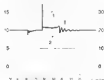
Make: Borel

- 1 Normal building-up of sparking voltage line
- 2 Normal sparking period
- 3 3 to 4 dying-outs



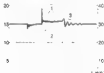
Make: Borel

- 1 Normal building-up of sparking voltage line
- 2 Normal sparking period
- 3 At least 3 dying-outs



Make: May & Christie

- 1 No building-up of sparking voltage line
- 2 Normal sparking period
- 3 At least 3 dying-outs

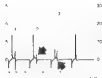


Make: Bosch

- 1 Normal building-up of sparking voltage line
- 2 Long sparking period
- 3 At least 3 dying-outs

IGNITION COIL FAULTS

Evaluation of ignition voltage peaks and dying-out process at idling speed.



- 1 Beginning of dying-out processes with normal peaks upwards and downwards
- 2 Beginning of dying-out processes strongly shortened (ignition coil is defective)?
- 3 Beginning of dying-out processes downwards (ignition coil is defective)?
Note: Higher ignition voltage peak is not always available.



Evaluation of sparking voltage line at idling speed

- 1 Normal sparking period
- 2 Normal dying-out to sparking voltage line (ignition coil is okay)



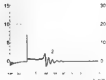
- 1 Shorter sparking period
- 2 Dying-out to sparking voltage line available or weakly shortened (ignition coil is defective)



- 1 Much shorter sparking period
- 2 Dying-out to sparking voltage line missing (ignition coil is defective)

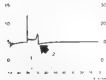


No sparking voltage line (ignition coil is defective)

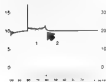


Evaluation of sparking voltage line at engine speed increased to approx. 1500 rpm

- 1 Normal sparking period
 - 2 Normal dying-out to sparking voltage
- Ignition coil is okay



- 1 Shorter sparking period
 - 2 Dying-out to sparking voltage line available only momentarily
- Ignition coil is defective!

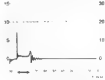


- 1 Normal sparking period
 - 2 Dying-out to sparking voltage line in idling
- Ignition coil is defective



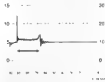
SPARK PLUG FAULTS

- 1 Normal ignition voltage peak
- 2 Spark plug is okay
- 3 Low ignition voltage peak
- 4 Small electrode gap
- 5 High ignition voltage peak
- 6 Large electrode gap

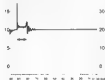


Evaluation of sparking period at idling speed

Normal sparking period
Spark plug is okay



Long sparking period
Small electrode gap



Short sparking period
Large electrode gap



Normal Spark Timing Displays With Normal RPM

Evaluation of sparking period and ignition voltage peaks at 1000 rpm

- 1 Normal sparking period
 - 2 Normal ignition voltage peak
- Ignition system is okay

Ignition Voltage Too High

Electrode gap
Compression
Fuel-air mixture
Electrode temperature
Electrode condition
Ignition lead

Large
High
Lean
Low
Burn
Interrupted



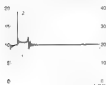
Long sparking period (1) with low ignition voltage peak (2)

indicates low compression
Fluctuating sparking period
indicates contamination on spark plug (shunt)

Ignition Voltage Too Low

Electrode gap
Compression
Fuel-air mixture
Electrode temperature
Electrode condition

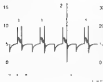
Small
Low
Correct
High
None



Short sparking period (1) with high ignition voltage peak (2)

Confirm but short sparking period
indicates defective ignition lead

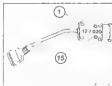
Note
The sparking voltage line could sometimes
be missing completely and the ignition
voltage peak could rise very high



Fault in Injection System

Evaluation of ignition voltage peak in response to sudden accelerator loads

- 1 Beginning of dying-out process is not much higher than ignition voltage peak. Injection system is OK.
- 2 Beginning of dying-out process is considerably higher than ignition voltage peak. Fault in the injection system.
 - a) Leak mixture
 - b) Defective injection valve
 - c) Low compressions



Additional fault notes for troubleshooting

For troubleshooting on the primary side of a single ignition coil, use adapter for primary current measurement (special tool 12 7 020).

If terminal 1 signal is not present on pin 1 to the diagnosis plug, the external trigger signal for the Service Tester can be prepared with the help of special tool 12 7 620.

Connect BMW Service Tester
Select Engine Test Step 06.

Enter number of cylinders (four).
Connect universal adapter to tester.
Connect brown clip to pin 6 ground. Attach each terminal to terminal 1 of special tool 12 7 020.

If there is no trigger signal in the diagnosis box for a 6-cylinder engine (presented a two-cylinder on the Service Tester).

The red inductive clip is not used as only one cylinder is being tested.
Consequently the engine speed display will be too low by factor 4.
Connect special tool 12 7 020 to the ignition coil being tested and the 4-cylinder cable harness.



Produce a stationary signal on the oscilloscope by pressing key R.
Note:

The sparking voltage line on the oscilloscope will be very thin, as the fuel-air mixture ratio of a 4-valve engine will be greater than that of a 2-valve engine.



**Examination of secondary
signal for passive ignition
distribution
(special tool 12 7 030)**

Engine Test Step 10

Remove ignition coil.
Clip special tool 12 7 030 on pertinent ignition
coil to be tested.
Clip high tension clip around ignition lead.



Connect ground lead of adapter to vehicle
ground and ignition coil. Connect up diag-
nostic plug.

If trigger signal is not present, (terminal 1),
connect black (ground) of a diverter adapter
cable to Pin 1 of the primary adapter cable.



Produce a stationary signal by pressing key R
on the tester.

Neighboring ignition leads could produce in-
terference on the screen of the oscilloscope.

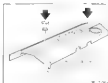
Refer to the fault memories of engine control
units for additional troubleshooting.
Interrogate fault memory and its fault reports
refer to Electrical Troubleshooting Manual.

12 13 011 Replacing ignition coil (M 20, M 30, M 40)

Caution!

Only work on the ignition unit with the ignition switched off - dangerous high tension voltage.
Note working instructions for ignition unit - see Page 12 80.

Remove protective cap and ignition lead (item 4).
Unscrew connections (terminals 1 and 15).
Tightening torque 12 13 1A2*
Unfasten bracket and remove ignition coil.



Remove oil filter cover.
Unsnap cover on retaining screws.
Unscrew bolts.



Remove cylinder head gasket.

Caution!

Ensure that no dirt falls into the open oil filter neck.
Close oil filter neck once cover has been removed.



Unscrew plug.
Pull off plug.

* Refer to Specifications

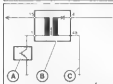


Unscrew bolts
(Pull out ignition coil)

Insulation resistance
Ground straps of the cylinder head cover must be secured on the ignition coils for cylinders 3 and 6.

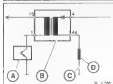


Caution!
Mutual ground connection of ignition coils (cable 4a) is connected on right end of the cylinder head.



Bosch DMG

- A Primary coil of ignition coil is controlled by the DMG
- B Ignition coil
- C 4a is mutual ground connection on the secondary coils of the ignition coils

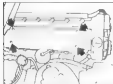


Siemens MS 40

- D Measuring resistance installed in the mutual ground connection for ignition coils. The measuring resistance is required for fault recognition in the secondary circuit of the ignition coils. The fault is stored in the engine control unit of the Siemens MS 40.



Caution!
To avoid destruction of the fault memory in a Siemens MS 40 engine control unit, only ignition coils from "May & Christe" may be used.



12 13 011 Replacing ignition coil (B38 B38)

Unfasten screws
Remove ignition coil cover



Disconnect plug from ignition coils



Unfasten ground connection (1) on the ignition coil of the 8th cylinder

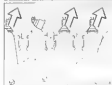


Unscrew coils
Remove ignition coils



12 13 011 Replacing ignition coil (M 60)

Unfasten and remove cover on screws in cylinder head cover
Unscrew bolts
Remove cover from cylinder head cover



Unfasten plug connections on ignition coils



Unfasten screws on the ignition coils

Installation restriction

On the ignition coils for cylinders 3 and 8, the ground straps (1) for the cylinder head cover must be secured to the ignition coil screws (see picture)



12 14 150 Replacing sensor for cylinder recognition (M 29, M 30, S36 S36)

Remove cover

Sensor is fitted to ignition lead No. 8
Disconnect suppressor plug from ignition lead
Disconnect sensor from ignition lead



M 29

Disconnect plug connection (2) - remove cable. Fit new sensor

1 = Inductive impulse sensor

2 = Cylinder recognition sensor



M 30

Disconnect plug connection - remove cable (2). Fit new sensor



S 36 S36

Unscrew screw

Remove cap



S 36 S36

Suppressor plug (1)

TOC sensor on vibration damper (2)
Magnet coupling air pump (3)

Removing fan and fan shroud including cover
see Gr. 1)

Note

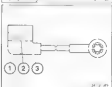
Unfasten water pipe



Installation instruction

Fit suppressor plug

See Construction Group (Pos. 12 12 077)



Check sensor

Measure resistance* of coil between leads 1 and 2

* Refer to Specifications



12 14 155 Replacing sensor for cylinder recognition (838 838)

Switch off ignition
Unscrew screw, remove cover



Disconnect plug (3)

TDC sensor on vibration damper (2)
Magnetic coupling for vibration damper (1)



Remove screw

Installation instruction
Replace O-ring

Read fault memory
Clear stored faults
Cancel fault memory

12 14 155 Replacing sensor for cylinder recognition (camshaft sensor M 50)

Function description: Bosch DME

- Design: Inductive sensor
- Only recognizes speed of camshaft
- Intermittent pulling on sensor plug connection to prevent its loose identity with the sensor on Siemens M848 engine control unit
- Fault memory in DME control unit
- Troubleshooting: refer to Electrical Troubleshooting Manual

Description for Siemens M848 Control Unit

- Design: Angle impulse sensor
- The speed and position of the camshaft is recognized
- Position of camshaft is recognized even at speed 0
- The sensor is supplied with high frequency by the control unit. Phase displacement is evaluated by the control unit
- Fault memory in M848 control unit
- Troubleshooting - see Electrical Troubleshooting Manual



Remove screw.



Mark plug (2) on cable harness and disconnect it.



Remove sender.
Installation instruction.
Check it is correctly seated on the rubber seal.



At 90 Tq (VANSOL - Variable Camshaft Control).
Disconnect plug connection on VANSOL adjust-
ment unit.



Unscrew bolt and
tightening cap nut.



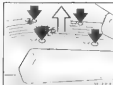
Check gasket, replacing if necessary.



Remove screw.



Mark plug (2) on cable harness and disconnect it.

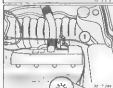


12 14 140 REPLACING CYLINDER HEAD THERMIST SENSOR (Cylinder Sensor) (M60)

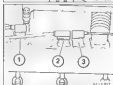
Interrogate fault memories
Switch off ignition
Undo caps on bottom of cover for cylinder
head cover
Unscrew screws.
Remove cover



Note
Routing of wiring on injection pipe



Disconnect plug (7).



Disconnect plug (1).



Unscrew screw

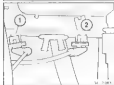


12 14 155 Replacing impulse sensor (M 30, M 30, M 40, S30 D30)

Check that impulse sensor is firmly sealed and not damaged.



M 40
Disconnect plug connection



M 30, M 30
Disconnect plug connection (1)

Note:
Remove protective cap from side



S30 D30

Disconnect plug (2)



12 14 155 Replacing impulse sensor (S30 D30)

Switch off ignition,
Remove screw, remove cover



Disconnect plug (2)



Remove screw,
Tightening torque 12 14 342*
Interrupt fault memory
Check faults stored in memory
Cancel fault memory

12 14 155 REPLACING PULSE SENDER (MSD)

Description of Bosch DME

- Design: inductive sender
- Different coding of sender plug connected root to avoid mix-ups with sender of Siemens MS 40 engine control
- Fault memory in DME control unit
- Troubleshooting: refer to Car Electric Electronic Test Plan.



Unscrew screws.
Remove cover



Unscrew screw

Installation

Ensure that the sender wire does not scrape on the increment gear after installation.

Description of Siemens MS 40

- Design: angle pulse sender
- Sender receiving high frequency power from the control unit. Phase of spikes sent between input and output signals is evaluated in the control unit
- Fault memory in MS 40 control unit
- Troubleshooting: refer to Car Electric Electronic Test Plan.



MS 40 TU VAMOS is Variable Camshaft Control.

Unscrew oil pipe at VAMOS control unit

Installation

Check seals, replacing them if necessary. Tightening torque*



Unscrew suspension eye bolts.

Installation

Check connection of ground strap (1).

Disconnect plug (2)



* Refer to Specifications



Unscrew pulse sender screw

Installation

Ensure that the sender wire does not
slip on the increment gear after
installation.

Tightening torque

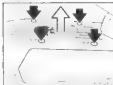


Remove wing bush



Mark location on wire harness and disc
red plug (2)

12-14/8



12-14 100 REPLACING PULSE SENDER (M60)

Interrogate fault memories.
Switch off ignition.
Unscrew caps on screws of cover for cylinder head cover.
Unscrew screws.
Remove cover.



Note:
Check for correct routing of wiring at water pump.



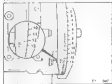
Disconnect plug (3).



Pulse sender is located close to crankshaft gear.



Unscrew sender (1).



Checking Intermediate Gear

M 39

- 1 TDC mark must be found at middle of a tooth.
- 2 Gap must be found after 8 teeth from the TDC mark in the engine's direction of rotation.

If not, replace vibration damper

M 35

- 1 TDC mark must be found at middle of a tooth gap.
- 2 Large gap must be found after one tooth from the TDC mark in the engine's direction of rotation.

If not, replace vibration damper

S 38

- 1 TDC mark must be found at beginning of the 12th tooth.
- 2 Large gap must be found after 11 teeth from the TDC mark in the engine's direction of rotation.

M 59

- 1 TDC mark must be found at middle of a tooth gap.
- 2 Large gap must be found after 13 teeth from the TDC mark in the engine's direction of rotation.

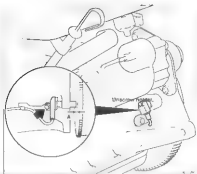


M 43

- 1 TDC mark must be found at middle of a tooth gap.
- 2 Base for the dowel pin must be found after 11 teeth from the TDC mark in the engine's direction of rotation.

12-14 100 REPLACING AND ADJUSTING SPEED SENDER (M 21)

Disconnect plug, unscrew lead.



Adjusting
Turn crankshaft 40 mm (1 5/8") further than the TDC mark.
Check whether dowel pin on the flywheel can be seen through take-up base of the speed sender.



Mount Special Tool 13 5 010 on the holder. Mount holder on the crankcase and push forward against the stop. This automatically adjusts the distance (A) required between the pin on the flywheel and speed sender (Special Tool 13 5 010 is 1.2 mm (0.051") longer than the speed sender).
Tighten the holder.



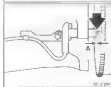
Unscrew Special Tool 13 5 010 on the holder and pull it out.

Important!

Holder must no longer be unscrewed on the engine block, only unscrew and pull out the special tool.



Slide speed sender into holder.
Screw speed sender.



Distance A: clearance between pin on the flywheel and speed sender.



12 14 050 REPLACING CONTROL UNIT FOR MOTOR, SECOND ELEC- TRONICS (CARE)

Interrogate fault memories
Switch off ignition
Unscrew bolts of cover
Remove cover



Remove control unit (1).

Note
Location of control units could differ de-
pending on version date of the model.
In case of doubt, remove concerned
control unit and check the part number.

12-14-000 REPLACING KNOCK SENSORS (MS)

Interrogate fault memory of engine control unit
Switch off ignition
Remove coolant collector - refer to G7-11

Caution

Mark plugs of knock sensors on the wire harness.
Mixing up plugs of knock sensors would lead to engine damage!



Knock sensor (1)

Installation
Tightening torque*



Installation

Flaring surface of knock sensor on engine block must be clean

Knock Sensor (1) for Cylinders 1 to 3

Location
Below temperature sensors close to water-
pump belt of alternator



Plug is located below idle speed control
(Idle speed control not shown) Plug
Mark plugs of knock sensors on wire
harness
Disconnect plug (1).



Knock Sensor (2) for Cylinders 4 to 6

Location
Above starter



Knock sensor (2)

Installation
Tightening torque*

* Refer to Specifications

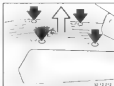
12-14/13



Plug is located below idle speed control
(idle speed control not shown here).
Mark plugs of knock sensors on wire
harness!
Disconnect plug (2)



Insulation
Bearing surface of knock sensor on engine
block must be clean



12 14 410 REPLACING KNOCK SENSORS ON RIGHT HAND SIDE (Cylinders 1 - 4, M50)

Interrogate fault memories.
Switch off ignition.
Undo caps on screws for cover of cylinder head cover.
Unscrew screws.
Remove cover from cylinder head cover.



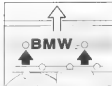
Loosen hose clamps on idle speed control and throttle valve assembly.



Disconnect plug on mass air flow sensor.



Unplug and remove air cleaner upper section together with mass air flow sensor.



Unplug caps on screws.
Unscrew screws.
Remove cover from cylinder head cover at right-hand side.



Unplug.
Disconnect plug on oil level switch.



Disconnect plugs on ignition coils.



Disconnect plugs.
1 Knock sensor for cylinders 3 and 4
2 Knock sensor for cylinders 1 and 2
3 Pulse sensor (on vibration damper)

Caution!
Mixing up plugs of knock sensors would lead to engine damage!



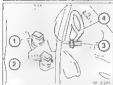
Disconnect plugs

- 1 Intake air temperature sensor
- 2 Throttle valve potentiometer
- 3 Idle speed control



Disconnect plugs

- 1 Diagnostic socket (unclip from holder)
- 2 Engine plug



Unclip intake ground wire of ignition point (2) close to rear engine suspension eye (3)



Disconnect plugs of temperature sensors

- 1 Temperature sensor (black) for temperature gauge
- 2 Temperature sensor (white) for digital engine electronics (DME)



Remove holder (1) for cover of collector
Unscrew screws



Disconnect throttle cable
Compress nipple mounts at both retainers and press out of operating lever



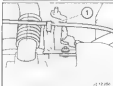
Press nipple out of nipple mount
Take cable out of nipple mounts



Take cable (1) out of rubber mount (2)
Take rubber mount (2) out of holder
Remove throttle cable



Unsnap cover off cylinder head cover at left-hand side (cylinder bank 5 - 6).



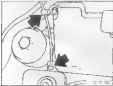
Routing of Throttle Cable

Take out of holder (1)



Cable with Cruise Control

Route cruise control cable (1) underneath throttle cable (2)



Routing of Cruise Control Cable on Cylinder Head Cover



Disconnect plugs on ignition coils



Disconnect plugs:

- 1 Camshaft sensor
- 2 Knock sensor for cylinders 5 and 6
- 3 Knock sensor for cylinders 7 and 8

Caution

Mixing up plugs of knock sensors would lead to engine damage



Disconnect plug (1)

Put off expansion (2)
Unscrew screws at left and right hand sides and place expansion take aside



Remove Expansion Panel



Disconnect plug on oil pressure switch.



Remove pipe on oil pressure switch.



Unscrew bolts of wiring ducts on cylinder head.



Disconnect vacuum hoses on radiator.
Loosen hose clamp.



- 1 Tank vapor vent
- 2 Vacuum supply for brake booster



Disconnect vacuum hose at brake booster.



Disconnect tank vapor ventilation hose at throttle valve assembly.



Disconnect fuel feed and return pipes.



Pull hose (1) off of and cover (2) on back of main leg



Unscrew bolts

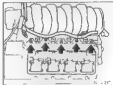
Installation
Tightening torque*

Important:
Pull off and cover together with pressure regulating valve straight back to avoid damaging vent pipe (1)



Installation

Check seal and gasket, replacing them if necessary



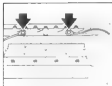
Unscrew bolts

Remove main fold upwards

Installation

Tightening torque*

* Refer to Specifications



Knock sensor 1 for cylinders 1 and 2
Knock sensor 2 for cylinders 3 and 4

Unscrew screws

Installation
Tightening torque*

Caution!

Mixing up plugs of knock sensors would lead to engine damage.
Routing of wires and connection of plugs must conform with original installation in car to avoid damage.

All engine fault memories

Investigate stored faults.
Eliminate faults.
Erase fault memory.

* Refer to Specifications



12-14-611 REP, ACWD KNOCK SENSORS
ON LEFT-HAND SIDE
(Cylinders 3 & 4, M60)

Interrogate fault memories.
Switch off ignition.
Unclip caps on screws for cover of cylinder
head cover.
Unscrew screws.
Remove cover from cylinder head cover.



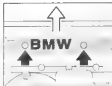
Loosen hose clamps on idle speed control
and throttle valve assembly.



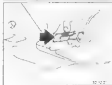
Disconnect plug on mass air flow sensor.



Unclip and remove air cleaner upper sec-
tion together with metal air flow sensors.



Unclip caps on screws.
Unscrew screws.
Remove cover from cylinder head cover on
right-hand side.



Oil cap.
Disconnect plug on oil level switch.



Disconnect plugs on ignition coils.



Disconnect plugs:
1. Knock sensor for cylinders 3 and 4.
2. Knock sensor for cylinders 1 and 2.
3. Pulse sender (on vibration damper).

Caution:
Mixing up plugs of knock sensors would
lead to engine damage!



Disconnect plugs

- 1 Intake air temperature sensor
- 2 Throttle valve position sensor
- 3 Idle speed control



Disconnect plugs

- 1 Diagnostic socket (snap from holder)
- 2 Engine plug

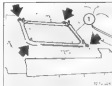


- 1 Unscrew nut and ground wire of ignition coils (2) close to rear engine suspension eye (4).



Disconnect plugs of temperature sensors

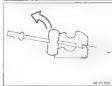
- 1 Temperature sensor (black) for temperature gauge
- 2 Temperature sensor (white) for digital engine electronics (OME)



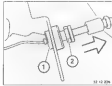
- 1 Remove holder (1) for cover of collector using three screws



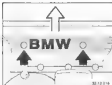
- 1 Disconnect throttle cable. Compress nipple mounts at both rear ends and press out of operating lever



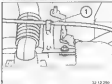
- 1 Press nipple out of nipple mounts. Take cable out of nipple mounts



- 1 Take cable (2) out of rubber mount (1). Take rubber mount (1) out of holder. Remove throttle cable

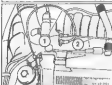


Unfasten cover of cylinder head cover on left hand side cylinder bank 9 - 10.



Routing of Throttle Cable

Take out of holder (1)



Cars with Cruise Control

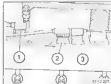
Route cruise control cable (1) underneath throttle cable (2)



Routing of Cruise Control Cable on Cylinder Head Cover



Disconnect plugs on ignition coils



Disconnect plugs

1. Camshaft sensor
2. Knock sensor for cylinders 5 and 6
3. Knock sensor for cylinders 7 and 8

Caution

Wiping up plugs of knock sensors would lead to engine damage!



Disconnect plug (1)

Put off split hose (2).
Jettison airways at left and right hand sides and place expansion tank aside



Coolant Expansion Tank



Disconnect plug on oil pressure switch



Remove pipe at oil pressure switch



Unscrew screws of wing nuts on cylinder heads



Disconnect vacuum hoses on radiator
Loosen hose clamp



- 1 Tank vapor vent
- 2 Vacuum supply for brake booster



Disconnect vacuum hose at brake booster



Disconnect tank vapor ventilation hose at engine valve assembly



Disconnect fuel feed and return pipes



Put head (1) off of and cover (2) on back of manifold

Unscrew bolts

Apply proper
tightening torque*

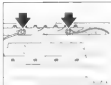
Important:
Pull off end cover together with pressure
regulating valve straight back to avoid
damaging vent pipe (3)

Insulation
Check seal and gasket, replacing them if
necessary

Unscrew bolts
Remove manifold upwards

In addition
tightening torque*

* Refer to Specifications



Knock sensor 1 for cylinders 1 and 2
Knock sensor 2 for cylinders 3 and 4

Unscrew screws

Apply proper
tightening torque*

Knock Sensors for Cylinders 1 - 4

Drain coolant



Remove water pump on back of cylinder
heads

Important:

Apply proper
tightening torque*
Refer to Group 18 for additional torque
data



* Refer to Specifications



Knock Sensor 3

Unscrew screw

install sensor
tightening torque*



Knock Sensor 4

Unscrew screw

install sensor
tightening torque*

Caution

Mixing up plugs of knock sensors would
lead to engine damage.
Routing of wires and connection of plugs
must conform with original installation in
car to avoid damage.

Interrogate fault memories
Investigate stored faults
Eliminate faults
Erase fault memories



ENGINE WIRE HARNESS RELAYS (M40, M43, M45, M50)

Unscrew screws
Remove cover



- 1 Engine control unit (Bosch DME or Siemens MS 42)
- 2 Eng. re control master relay
- 3 Electric fuel pump relay
- 4 Oxygen sensor heating relay (not installed with Siemens MS 40)
- 5 ABS control unit



ENGINE WIRE HARNESS RELAYS (M51)



- 1 Pre-heating relay
- 2 Fuel transfer pump relay
- 3 DGE (Digital Diesel Electronics) master relay

Relay allocation on engine cable harness (M 60)

Unscrew screws
Remove cover



- 1 Control unit for Digital Engine Control
- 2 Control unit for Automatic Transmission
- 3 Control unit for ABS



- 1 Main relay for engine control unit
- 2 Relay for electrical fuel pump
- 3 Relay for Lambda oxygen sensor heating

Note

Depending on the model of the car, the installation location for the relays can differ. In case of doubt, consult different relays to check whether the desired function information has been achieved.

12 21 500 REMOVING AND INSTALLING OR REPLACING RELAY FOR GLOW PLUGS

Interrogate fault memory
Disconnect battery ground lead
Remove insulation sheet

Unscrew bolts
Remove cover

Removes control unit (1).

Press retaining hook back and pull control
unit out.
Disconnect plug.



Check 30 ampere fuse.
Replace if defective.
Unscrew screws.
Tightening torque*
If fuse has failed, always check for cause
of fault.
Continue with checking glow plugs - refer
to 12 22 500.

Unscrew positive lead
Tightening torque*

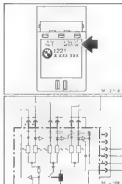
Removing the control unit will be easier if
the screws of the equipment carrier are
removed.

Note
Reary is extracted directly from control unit
of Digital Diesel Electronics.

Wiring Diagram

01	02	Glow plugs 1 - 3
Term. 15		Positive switched in by ignition switch
Term. 30		Battery positive
Term. 21		Battery ground
01a		Control voltage
01a		Diagnosis interface

* Refer to Specifications



Plug Connections

Printed on control unit.

Pin No.	wire Color.	Steer Plug Cyl
6	black/green	1
8	black/violet	2
7	black/yellow	3
3	black/red	4
2	black/white	5
1	black/brown	6

Continue with troubleshooting. Refer to the
 Car Electronic/Electronic Test Plan for Digital
 Diesel Electronics (DD6 3).

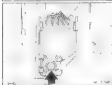


12-23-090 Checking all heater plugs

Battery voltage > 9 V
 Switch on ignition.
 Remove cover on control units.



Disconnect plug connections from control unit (1).



Remove cover from positive battery terminal.

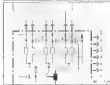


Connect measuring cable (special test numbers 81 1 473 and 81 11 473) to ammeter. Connect up ammeter between plug connection on cable harness (2) between heater plugs and positive battery terminal (1) and read off current intake level.*

* Refer to Specifications

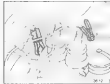


Plug Pin Connection
 Printed on control unit



Pin No.	Wire Colors	Heater Plug. Cyl
6	black-green	1
8	black-violet	2
7	black-yellow	3
3	black-red	4
2	black-white	5
1	black-brown	6

Caution!
 Never operate removed heater plugs. Danger of injury and fire!



Check with BMW test tester*

Disconnect plug on control unit.
 Connect red lead (1) of tester on battery positive.
 Connect blue lead (2) of tester on battery ground.

* Source of Supply: BMW Parts Service

12-23/2



Circuit diagram - see 12-23.1 Inset measuring cable (special tool number 81 1 473) w/ plug connection of heater plug being inspected.
Connect black lead on test device to measuring cable.

Wait until red lamp lights up, eq. present is ready for testing.
Press start button on tester - green lamp lights up.

Needle in green zone
Heater plug in good working order

Needle in red zone
Heater plug is faulty
Time of test: approx. 10 seconds

Test completed
Red lamp lights up.
Continue with next heater plug

Caution!

Additional troubleshooting
If a faulty heater plug is found during the test, it is essential to also check the supply lead from the control unit to the heater plug.
Example: Tightness of screws on heater plug, continuity test of supply lead and tightness of AC fused controller (on supply lead)

If other disturbances occur even though the heater plugs are okay, check the activation of the heater plug relay, the heater plug relay itself and the 80 amp fuse on the heater plug relay.
Also refer to the Electrical Troubleshooting Manual, Section 1050, Digital Ocean (Sea-Service)

12 23 505 REPLACING ALL GLOW PLUGS

Interposes fault memory.
Disconnect battery ground lead.

Remove covers.

Location of glow plugs

Unscrew lead screw
"tightening torque"

Refer to Specifications

Unscrew lead screw
"tightening torque"

Unscrew glow plugs using Special Tool
12 2 180
"tightening torque"

Refer to Specifications





12 31 000 Checking 3-phase alternator and voltage regulator

Prerequisite for the inspection:

Correct connections to charged battery
Correct connections to alternator and

Good ground connection between engine and body
Tight Vee belt



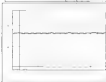
If the battery charge indicator lights continuously:
Remove voltage regulator and check carbon brushes, replacing if necessary 12 31 000
Minimum length "A" 5 mm

Caution

Some alternators have normal regulators and some alternators have constant voltage regulators.
The regulators are coded mechanically and must not be confused!



Normal regulator



Constant voltage regulator

Can be identified by the mechanical coding.

Under no circumstances may the constant voltage regulator be installed in vehicles with a battery in the engine compartment. This would result in damage to the battery.

Inspection instruction

Check scraper rings for signs of wear, pre-oil-starting if necessary and polishing.
Connect up BARM MEWCO TESTER.
Start engine and compare readings with nominal values.

If the charge control light goes out while the engine is running and the constant voltage* is not achieved, and if the oscillogram is okay (see per illustration), the voltage regulator must be replaced 12 31 000.

For additional oscillograms, see Electrical Troubleshooting Manual, 7 Series.

If the specified charge current is not achieved, remove and dismantle the alternator and inspect the components.

For additional troubleshooting and instructions on disassembly of the alternator, see Construction Group Paper Manual, Group 12.



* Refer to Specifications



12 31 020 Removing and installing 3-phase alternator (M 20, M 21, M 30, M 40, S 30)

Disconnect negative terminal from battery (Or pos. terminal on the flow sensor).

M 21 M 30 battery under rear bench seat on right.



M 20 Remove air filter with volume air flow sensor.

Remove plug, loosen hose clip, unlatch retaining screws, lift up air filter with volume air flow sensor, unlatch retaining screws from coolant hose and fit air filter together with volume air flow sensor.

Note:

S 30 Removing fan and fan shroud, see Gr 17
Removing suction filter housing, see Gr 13.



Remove coolant air hose.
Loosen hose clamps.

Note:

M 20 Remove coolant hose prior to disassembly.



Alternator remove protective cover.



Alternator

Unlatch leads on connection B+ term. 30 and D+ term. 31).

Tightening torque 12 31 14,2"



Loosen upper nut and remove screw together with tensioning wheel.
Loosen lower nut and remove screw (leads D+ B+ removed).



Alternator instruction

Tensioning wheel* (M 20 version)
see 12 31 200



12 31 000 REMOVING AND INSTALLING ALTERNATOR (M20)

Disconnect battery ground lead.
Remove compass or cleaner.
Remove alternator vent hose.
Remove fan and fan cover.

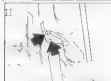


PRECAUTION

Ensure that tab of the ribbed drive belt contacting roller engages in the opening.



Loosen and remove the ribbed drive belt.



Remove corner from connections.
Unscrew wires.
Tightening torque*



Unscrew screws.
Remove alternator.

* Refer to Specification

12-31/4 REMOVING AND INSTALLING OR REPLACING ALTERNATOR (M30)

Refer to general information on page 12-52.
Interrogate fault memory.
Disconnect battery ground lead.



Leave short section of extension inserted between belt tensioner and coolant pipe charge air pipe.
Belt tensioner remains preloaded.



Unscrew cap, swirl off oil from filter and remove oil filter standstill.



Unscrew holder of engine oil pipes on alternator.



Stack ribbed drive belt.
Stack the automatic belt tensioner using a suitable lever (e.g., short and long ratchet extensions).
Apply short ratchet extension at front end.



Unscrew power steering supply tank screws on engine carrier.



Pull cover off of wiring harness connections on alternator.
Unscrew wires.
Tighten torque.

Refer to Specifications.



Uncrew bolts of charge air cooler and EGR valve



Uncrew coolant expansion tank and its

Important*

Always wrap rags around ends of pipes before disconnecting engine oil pipes on oil filter so that escaping oil will not run into and collect in the engine guard. Complaints about "oil leakage" would be the result.



Uncrew engine oil pipe coupling on oil filter
Remove engine guard.
Tightening torque*

* Refer to Specifications



Uncrew alternator bolts
Tightening torque*



Installation

Press bushings out on engine carrier before installing the alternator. The alternator will then be easier to install.

1 = Location of bushings after removal
2 = Installed position



Lower bracket

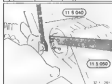
* Refer to Specifications

12-31-500 REMOVING AND INSTALLING OR REPLACING ALTERNATOR (500)

Interrogate fault memories of control units as disconnecting the battery will erase fault memories.
Disconnect battery ground lead.
Refer to general information on page 12-0-1

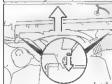


Remove holder of vacuum hoses on fan cover.



Remove fan.
Unscrew fan bolt using Special Tools 11 9 040 and 11 9 050.

Important!
Left-hand threads.
Installation
Tightening torque*



Remove fan cover.
Remove clips at left and right hand sides and remove cover upwards.

* Refer to Specifications



Arrangement of Ribbed Drive Belt

Installation
Inspect ribbed drive belt for traces of coolant or oil. Replacing it is necessary



Loosen nuts (1) and (2) to loosen the ribbed drive belt



Installation
Inspect ribbed drive belt and check tension: belt seating on pulleys.
Preload adjusting plate up to end of slot (2) by turning hexagon (3).
Tighten nuts (2).
Tightening torque*



Unscrew nuts (1) and bolt (2).
Remove ribbed drive belt tensioner

* Refer to Specifications

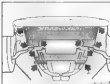


Loosen nuts (1) and (2) at oil filter so that oil filter can be pulled forward about 4 mm.



Unscrew alternator mounting bolts (1 and 2).

Installation
Tightening torque*



Lift car.
Unscrew engine splash guards.



Disconnect vent hose of alternator at alternator.

* Refer to Specifications.



Unscrew lower alternator mounting bolt.

Installation
Tightening torque*



Push alternator forward.
Unclip tape on connections.
Unscrew connections.

Installation
Tightening torque*



Lower car.
Take radiator hose out of clamp (1).



Unclip radiator at left and right hand sides by pressing in retainers with a screwdriver.

* Refer to Specifications.



Installation
Insert clip in radiator and compress until engagement is heard several times.



Protect radiator with sheet metal plate (1) to avoid damage while removing alternator. Unscrew water pump pulley.

Installation
Tightening torque*



Pull out filter forward slightly. To remove the alternator, alternator mounting (1) must be turned clockwise under rear of filter mounting (2).

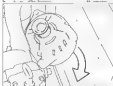


Pull alternator forward.

* Refer to Specifications.



Remove alternator upwards.





12 28 200 CHECKING AND MONITORING ALTERNATOR DRIVE BELT (W/D, W/O, H&E)

Check and, if necessary, adjust tension of the drive belt using Special Tool 11 5 020. The putting hook must bear in the middle of the pulleys.
The tester needle must be above the green or yellow zone on the scale.



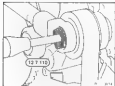
Tightening Drive Belt

Loosen nut (1) and turn tensioning wheel (2) with approximately 7 Nm torque.
Tighten nut (1).

Check drive belt tension with the special tool again and correct if necessary.

Drive Belt Tension Tester

With a "new scale" for SA drive belts.
SA = Service reduced.



12 31 ... Replacing alternator pulley

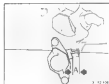
Unfasten nut with spanner tool 12 7 110

Grip shaft of rotor with Allen key.

Tightening torque 12 31 34.2*

12 32 000 REPLACING VOLTAGE REGULATOR

Disconnect ground leads from batteries



Installation

Clean the contact surfaces and check tension of the spring contacts, bending to correct if necessary.
Distance A = at least 5 mm



Remove alternator - refer to 12 31 000
Unfasten cover



Unfasten spring
Remove voltage regulator



Check slip ring for wear and machine if necessary - refer to 12 31 000 in the
Construction Group Repair Manual

12 41 02D Removing and installing starter motor (M 20, M 21, M 20, S 28)

Read fault memory

Disconnect negative battery terminal



M 21 M 20

Remove expansion tank - improves access to the screws

On M 21 remove support for manifold



Removing manifold for intake air, see Qr 11



Remove belts



Remove retaining nuts
Tightening torque*

Installation instruction

Fill with coolant** and bleed cooling system - see Pqs 12 5 02B

Notes on troubleshooting and disassembly of the starter motor - see Construction Group Repair Manual Qr 12

* Refer to Specifications

** Refer to Consumable Specifications

12 41 020 Starter - Remove, install, re- piece (M40)

See General Data, Gr 12 00.
Interrogate fault memory.
Disconnect negative terminal on battery.

Installation instruction:
Check starter pinion for damage.
Check starter gear ring for damage prior to in-
stallation of starter.

Notes on troubleshooting and disassembling
the starter motor, see
Construction Group Repair Manual Gr 12.



Remove nuts on starter motor.
Tightening torque*



Unscrew screws and support.
Tightening torque*
Remove starter motor.



* Refer to Specifications

12-41 020 Removing and installing the starter motor (M 56)

See General Data, Gr 12 08
 Interrogate fault memory
 Disconnect negative battery terminal
 Remove vent hoses on alternator
 Removing complete make glow housing,
 removing complete air repositol, see Gr 13



Installation instruction

Check starter pinion for **damage**.
 Check starter gear ring for damage prior to its
 installation of starter

Notes on troubleshooting and disassembly of
 the starter motor see
 Construction Group Repair Manual Gr 13



Remove main cable from starter motor
 'tightening torque'



Unscrew pinion and support
 'tightening torque'
 Remove starter motor



* Refer to Specifications

12 41 620 Removing and installing the starter motor (H45+)

See General Data Gr. 12 90
Interrogate fault memory
Disconnect negative battery terminal



Unscrew screw at rear support for manifold



Unscrew oil dipstick screw

Caution!
When engine oil level is high, oil may run out of the dipstick tube.
Remove oil dipstick.



Installation instructions.
Check O-ring, replacing if necessary



Unscrew screw on starter.
Tightening torque*



Unscrew bolts.
Tightening torque*
Starter support (if fitted)
Tightening torque*



Unscrew starter below oil filter



Installation instructions.
Check starter pinion for damage.
Check starter gear ring for damage prior to installation of starter.
Notes on troubleshooting and disassembly of the starter motor, see
Construction Group Repair Manual Gr 12

* Refer to Specifications

12 41 029 Removing and installing or replacing starter motor (M 60)

Note: General Data Group 13-0
Disconnect negative battery terminal.

Remove splash guard



Remove heat baffle plates on right
Unscrew bolts



Remove heat baffle plate on starter motor
Unscrew bolts



Remove heat baffle plate from front of front
axle corner



Loosen screw connection of starter motor
max.
Tightening torque*



* Refer to Specifications



Uncrew bolts
Tightening torque⁴



Remove starter motor by lifting out from back
of ring gear



Remove starter downstream



Check pinion on starter motor and starter
motor ring gear on flywheel for signs of dam-
age
Notes on troubleshooting and disassembly of
the starter motor: see
Construction Group Repair Manual Gr. 12

⁴ Refer to Specifications

12-64 005 REPLACING FUEL HEATER

The electronics for diesel filter heating is highlighted in upper section of filter. The heating element and water level probe are integrated in upper section of filter and can be replaced only together with the complete fuel filter.

Caution!

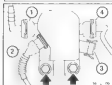
Heating element could have temperature up to 120 °C - danger of injury!

Description of Operation

Heater switches on terminal +B on and fuel temperature less than $+2 \pm 2^{\circ}\text{C}$

**Wiring Diagram**

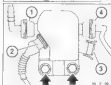
- 1: NTC sensor for temperature of supplied fuel
- 2: PTC heating element
- Term. 15: Battery positive switched on by ignition switch
- Term. 30: Battery positive
- Term. 31: Battery ground

**3 x Fuel heater plug**

Disconnect plug (2) for water level probe and plug (3) for fuel heater

**Plug Connections.**

- Pin 1: Terminal 30
- Pin 2: Terminal 31
- Pin 3: Terminal 15

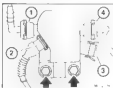


Press retainers and pull pipes (1 and 4) off

Caution:
Catch escaping fuel

Preparation

Check seals and, if necessary, replace
Cool seals with acid-free grease



Unscrew bolts and remove filter.
Tightening torque*

Empty filter into a suitable container

Installation:

Bleed fuel system: refer to 13.21.120.

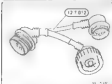


12 70 500 CHECKING SAFETY PATH OF ELECTRONIC ENGINE POWER CONTROL (EML)

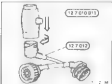
Note

Interrogate the fault memory of the EML control unit before installing the test adapter.

Switch ignition off.
Disconnect EML plug.



Cars with 30 Pin EML Plug
Use test adapter, Special Tool 12 7 010 011



Cars with 25 Pin EML Plug
Special Tool 12 7 012 (adapter) must be used between the EML wire harness and Special Tool 12 7 010 011 (test adapter).

Connect the BMW Service Tester to measure speed.

Testing Procedure

Regulate test adapter 12 7 010 011 to middle position "0".

Take out gear (neutral).

Start engine.

Regulate idling speed with knurled wheel of the test adapter to at least 2000 rpm.

Now operate brake pedal immediately.

The engine speed must "immediately" drop to idling speed.

If yes, the safety path is OK.

Repeat this test with the clutch pedal in car with a manual transmission.

Refer to the Car Layout/Electronic Test Plan for troubleshooting instructions.

Switch ignition off.

Remove adapters.

Connect plug.

Note

Interrogate the fault memory to erase the stored faults and eliminate the faults.

Cancel the test memory.



Installing Pedal Value Sender

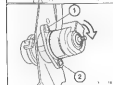
Picture shows the opening in the pedal



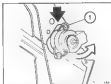
Turn pedal value sender until mounting tabs (1 and 2) are located above the mounting holes of the pedal console



Then tilt the pedal value sender upwards at an angle until it can be put through the opening in the pedal console



Insert pedal value sender fully



Turn pedal value sender until eye (1) can be put through the oval opening of the pedal console



Eye (1) mounted in pedal console



Turn pedal value sender until eye (2) can be put through the oval opening of the pedal console
Screw on pedal value sender

Mount plug
Adjust pedal value sender and check function - see Adjusting Accelerator in 12 72
Check safety path - see 12 70 500

12 72 120 REMOVING AND INSTALLING OR REPLACING PEDAL VALUE SENDER

Turn ignition off
Remove trim panel for the dashboard
at bottom left – see 51 45 180

Unscrew it and pull lever off of the
pedal value sender

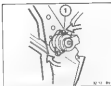
Installation
Adjust accelerator – see 12 72

Unscrew both bolts.
Disconnect plug

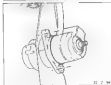
Installation
Use spacers between the sender and
pedal console

Removing Pedal Value Sender

Turn pedal value sender until eye (2)
can be taken out through the opening.



Turn pedal value sender until eye (1)
can be taken out



Turn pedal value sender until the clips
of the cover can be taken out of the
opening first.
Remove pedal value sender



Turn pedal value sender until eyes are
again aligned with the hole pattern of
the holder





Installing Pedal Valve Sender

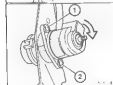
Picture shows the opening in the pedal console



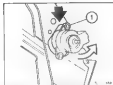
Turn pedal valve sender until mounting tabs (1 and 2) are located above the mounting holes of the pedal console



Then tilt the pedal valve sender upwards at an angle until it can be put through the opening in the pedal console



Insert pedal valve sender fully.



Turn pedal valve sender until eye (1) can be put through the oval opening of the pedal console.



Eye (1) mounted in pedal console



Turn pedal valve sender until eye (2) can be put through the oval opening of the pedal console
Screw on pedal valve sender

Mount plug
Adjust pedal valve sender and check function - see Adjusting Accelerator in 12 72
Check safety path - see 12 75 500

12-72... ADJUSTING ACCELERATOR PEDAL WITH ELECTRONIC ENGINE POWER CONTROL

1. Idle Position

Loosen hexagon nut (1) on pedal value sender.

Produce a gap A of 3 mm (0.118") or 2 mm (0.079") for 534 id before the accelerator pedal shaft and idle stop (2). Tighten hexagon nut (1) on pedal value sender to correct figure*.

Support lever on pedal value sender while tightening.

2. Full Load Position

a) Manual Transmission

Operate accelerator pedal to kickdown pressure point in the pedal value sender. Turn knurled head screw (3) to bear on the accelerator pedal in this position and lock.

b) Automatic Transmission

Operate accelerator pedal to kickdown pressure point in the pedal value sender. Adjust knurled head screw (3) in this position to have a distance of 8 mm (0.315") between the knurled head screw and accelerator pedal. Lock the knurled head screw.

Important*

Check pedal value sender with a diagnostic tester after adjusting. Connect tester, turn on ignition and press accelerator pedal to the full load stop. Compare actual voltage value displayed on the tester with the nominal value, correcting the adjustment if necessary.

Idle = min. 353 mV

Idle = max. 454 mV

Notes

No safety path test for 534 id.

Specifications:

a) Manuals = 3.15 ... 3.3 V

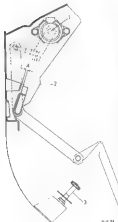
b) Automatics = 3.7 ... 3.8 V

Check safety path - see 12-70 560 in Construction Group Repair Manual.

Note:

Read DML fault memory before installation of the testing adapter.

* See Specifications



On-board Diagnostics

The DME control unit recognizes on-fault relevant faults and displays them by lighting up the "Check Engine" control lamp continuously. Check Engine control lamp - see Group 63. The fault lamp comes on after turning on the ignition and goes out when the engine runs. If it is on continuously while the engine is running, it there is a fault.

Flashing codes help in locating faults precisely and eliminating them.

Fault Output

Activate flashing code output - Ignition ON - operate full load contact 5 times within 5 seconds.
Fault output begins.
See sample fault - faulty NTC coolant - code 1223.

1 = Start of fault code

2 = End of fault code

Lamp Off

Lamp On

Sample Fault Code NTC Coolant Code 1223

4 - 11



5 times full load stop within 5 sec. with ignition ON

5 s Lamp ON

0.5 s Lamp OFF

2.5 s Lamp ON

2.5 s Lamp OFF

Flash 1 - 2 times*

2.5 s Lamp OFF

Flash 2 times

Note number

2.5 s Lamp OFF

Flash 1 - 5 times

Note number

2.5 s Lamp OFF

Flash 1 - 5 times

Note number

2.5 s Lamp OFF

Note

Each additional call must be activated again.

Code 0044 - fault no longer stored

Code 0000 (long dark phase) - after

fault output - end of output

* Two times for M 70 Left cylinder bank

FAULT CODE TABLE

Code	Faulty Component
x011	Control unit (self-test)
x015	Air flow sensor
x021	Oxygen sensor
x022	Oxygen sensor control stop
x023	NTC coolant (see sample fault)
x024	NTC air
x021	Battery voltage monitor
x002	Idle speed switch
x003	Full load switch
x051	Fuel injector final stage 1
x052	Fuel injector final stage 2
x061	Fuel pump relay final stage
x082	Idle control final stages
x093	Tank venting final stage
x094	Relay 2 final stage (oxygen sensor heating)

Table 1. CAN-Bus Flashing Code Scope

Remarks:

x = 2 for M70 control unit of left engine half (cyl. 7 ... 12)

x = 1 for M70 control unit of right engine half (cyl. 1 ... 6) and all other engines

Fault memory empty: Code x044

Methods of Cancelling Fault Memories

- 1 Disconnect DME control unit (permanent positive, pin 18) on power supply, e.g. by unplugging control unit.
- 2 With help of BMW SERVICE TESTER:
Command: cancel fault memory (see car electric/electronic test plan)
- 3 Re-activation with ignition OFF while flashing code output x000 is put out, close full load switch 10 seconds

Remarks:

FL = Fault lamp

VL = Full load

13 Fuel system

518i (M40), 520i (M20, M50), 525i (M20, M50), 530i (M30), 535i (M30). .

M5

524d (M21), 524td (M21)

525td (M51), 525tds (M51)

530i (M60), 540i (M60)

13 Fuel system

Models : 518i (M40), 520i (M20, M50), 525i (M20, M50), 530i (M30), 535i (M30)

Model 518i (M43) refer to "Repair Manual 3 Series E36"

13 00 060	Engine idle speed and CO content (M20, M30) – check	13-00/1
	Engine idle speed / CO content (M20, M30)	13-00/2
	Basic setting of air flow meter adjusting screw (M20, M30) – check	13-00/2
054	Engine idle speed and CO content (M50) – check and, if necessary, adjust	13-00/3
060	Engine idle speed and CO content (M50) – check	13-00/4
060	Engine idle speed and CO content (M40) – check	13-00/5
	Overview of fuel filters and lines	13-32/1
13 32 051	Fuel filter – replace	13-32/1
13 41 800	Idle speed control valve (M40) – replace	13-41/1
500	Idle speed control valve (M20, M30) – replace (check)	13-41/2
500	Idle speed control valve (M50) – replace	13-41/3
13 51 630	Fuel pressure regulator (M50) – replace	13-51/1
630	Fuel pressure regulator (M40) – replace	13-51/2
13 54 030	Throttle assembly (M50) – remove and install/replace	13-54/1
030	Throttle assembly (M40) – remove and install/replace	13-54/2
13 61 000	Control unit – remove and install or replace	13-61/1
13 62 000	Air flow meter (M40) – remove and install	13-62/1
000	Air flow meter (M20) – remove and install	13-62/2
000	Air flow meter (M30) – remove and install	13-62/3
560	Air mass meter (M50 M50 B20 TU) – remove and install	13-62/4
560	Hot film air mass meter (M50 B25 TU) – remove and install	13-62/5
511	Intake air temperature sensor (M50) – replace	13-62/6
531	Coolant temperature sensor – remove and install or check	13-62/7
531	Coolant temperature sensor (M50) – remove and install or replace	13-62/8
13 64 541	Fuel injector valves – all (M20) – replace	13-64/1
541	Fuel injector valves – all (M30) – replace	13-64/2
541	Fuel injector valves – all (M50) – remove and install	13-64/3
13 71 000	Air cleaner (M20) – remove and install	13-71/1
13 72 001	Air cleaner cartridge (M20) – replace	13-71/1
13 71 000	Air cleaner (M30) – remove and install	13-71/2
13 72 001	Air cleaner cartridge (M30) – replace	13-71/2
13 71 000	Air cleaner (M50) – remove and install	13-71/3
13 72 001	Air cleaner cartridge (M50) – replace	13-71/3
13 90 500	Tank ventilation valve (M20, M30) – replace	13-90/1

For further information on troubleshooting and jobs in assembly 13 refer to
 Microfiche Assembly Repair Manual and
 Electrical Troubleshooting Manual 5 Series E34

For M43 engine refer to

For other jobs refer to "Repair Manual 3 Series E36"

13-00-000 CHECKING ENGINE IDLE SPEED AND CO CONTENT (M20, M20i) Cars with Catalytic Converter

Requirements for All Adjustments
 Engine at operating temperature, i.e. oil temperature at least 60 °C
 Valve clearance correct
 Engine and gearbox in perfect operating condition
 Connect BMW Service Tester to operating accessories
 Routine checking is not necessary

1) Engine Idling Speed

Check engine idling speed**
 Refer to BMW Diagnosing System if nominal value is not reached
 Check intake system for leaks

Notes
 There is no adjusting screw for idling speed adjustment

2) CO Content

Disconnect oxygen sensor plug (only if cars prepared for catalytic converter)
 Unscrew screw (1)
 Connect special tool 13-0-100 to exhaust manifold
 Check idling speed CO content*
 Switch exhaust extraction system off for time of test

Warning Value Not Reached and CO Content Too High
 Check

- fuel injectors
- fuel pressure and coolant temperature sensor

CO Content Too Low
 Check hoses and connections for engine idling speed control and detect air leaks

** Refer to Specifications

Important!
 Also valid for cars prepared for catalytic converter
 Adjustments may not be made on the air flow sensor adjusting screw, since this setting is the basis for oxygen sensor and idling speed control

Checking Function of Oxygen Sensor (11-75-010)

Unscrew screw (1)
 Connect Special Tools 13-0-100 to exhaust manifold
 Switch exhaust extraction system off for time of test
 Disconnect oxygen sensor plug
 Clamp adjuster hose leading to the fuel pressure regulator (not while engine is running)
 Start engine - CO content rises
 Connect oxygen sensor - CO content should go back to the nominal value
 Remove clamp from vacuum hose

For air flow or air volume measurements (M20) with the potentiometer the adjustment does not have influence on catalytic converter and idling speed regulation in catalytic converter operating mode.
 The plug for the CO potentiometer, however, must be disconnected - refer to G1-10



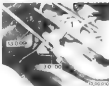
Fig. 13-0-01

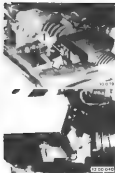


Fig. 13-0-02



Fig. 13-0-03





13-00 ENGINE RUNNING/CO-CONTENT (M20, M20i)

Only for cars prepared for catalytic converter operation

If it is absolutely necessary to correct¹⁾ the CO-engine running setting with the air volume sensor adjusting screw or if the adjusting screw had been turned unnecessarily, the basic setting must be checked and/or repeated when converting to a catalytic converter or working on the fuel-air mixture system.

- ¹⁾ Corrections may never be carried out when there is a fault in the fuel-air mixture system.
Read the fault-diagnosis, check for leaks in the intake and fuel systems, check fuel injections, temperature sensor and fuel pressure - also refer to 13-00 260.



13-00-041



13-00-042



13-00 CHECKING BASIC SETTINGS OF AIR VOLUME SENSOR ADJUSTING SCREW (M20, M20i)

Only for cars prepared for catalytic converter operation (anti-tamper lock in catalytic converter (LAP))

M 1.1 and M 1.3 specify: Measure distance "A" at the adjusting screw with a depth gage and compare or adjust to the value also stamped in the air volume sensor²⁾

Install an anti-tamper lock on the air volume sensor after converting the car to catalytic converter and checking the basic setting

Car with Potentiometer (A) Air Flow or Air Volume Sensor

The setting of the adjusting screw can be read and/or corrected via the diagnosing system of a Staro Service Tester

When converting to a catalytic converter, the CO potentiometer plug must be disconnected (refer to Group 12). The setting of the adjusting screw is then without influence

13 50 054 CHECKING ENGINE IDLING SPEED AND CO CONTENT (MSD)

Cars Prepared for Cat. Code -

Engines with M 3.1 Injection
Requirements for All Adjustments
Engine is operating temperature, i.e. air
temperature at least 50 °C
Engine idling position in perfect operating
condition
Even number of cylinders (8) for engine
idling speed test step no. 5
Connect BMW Service Tester to operating
instructions
Routine checking is not necessary



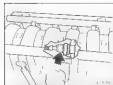
If the nominal value is not reached, first
make sure that there are no faults in the
engine, ignition or fuel injection before
correcting the CO content setting.

CO Content Too High Check

- fuel injectors,
- fuel pressure and
- coolant temperature sensor

CO Content Too Low

Check hoses and connections for engine
idling speed control and detect air leaks.
Also refer to BMW Diagnosing System.



1) Engine Idling Speed

Check engine idling speed**
Refer to BMW Diagnosing System if nomi-
nal value is not reached.
Check intake system for leaks.

Tip:
There is no adjusting screw for idling speed
adjustment.
Clicking of the idling speed control valve
must be heard and felt when switching the
ignition on.



3) CO Content

Connect exhaust sensor in exhaust tailpipe.
Check idling speed CO content**
Switch exhaust extraction system off for
idle CO test.
If the nominal value is not reached, the CO
content** of cyl. 1, 2 and 3 or cyl. 4, 5 and 6
can also be checked separately to trouble-
shoot.

** Refer to Specifications of Gr. 51 and 13



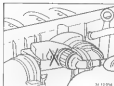
The CO content is corrected via the M 3.1
diagnosing program with MoDiC

The setting of the adjusting no longer has
any influence in all cars with the said
engine.

Refer to the BMW Test Plan for further
instructions.

13-00 085 CHECKING ENGINE IDLING SPEED AND CO. COEFFICIENT (M30) - Carb with Catalytic Converter

Requirements for All Adjustments
Engine at operating temperature, i.e. oil temperature at least 50 °C.
Engine and ignition in perfect operating condition.
Connect BMW Service Tester to operating instructions.
Routine checking is not necessary.



If the nominal value is not reached, first verify again that there are no faults in the engine, ignition or fuel injection before correcting the CO content setting.

Also refer to BMW Diagnosing System.

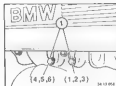
The setting of the adjusting no longer has any influence in all cars with the M30 engine.

Refer to the BMW Test Plan for further instructions.

1) Engine Idling Speed

Check engine idling speed**
Refer to BMW Diagnosing System if nominal value is not reached.
Check intake system for leaks.

Note:
There is no adjusting screw for idling speed adjustments.



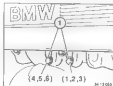
2) CO Content

Disconnect oxygen sensor plug that has been prepared for catalytic converter.
Unscrew screws (1).
Connect Special Tool 13 0 080 to exhaust manifold.
Check idling speed CO content**
Switch exhaust extraction system off for time of test.

Nominal Value Not Reached and CO Content Too High
Check:

- fuel injection,
- fuel pressure and
- coolant temperature sensor

CO Content Too Low
Check hoses and connections for engine idling speed control and check air leaks.



Checking Function of Oxygen Sensor (1) 28 5100

Unscrew screw (1).
Connect Special Tools 13 0 080 to exhaust manifold.

Switch exhaust extraction system off for time of test.

Disconnect oxygen sensor plug.
Clamp vacuum hose leading to the fuel pressure regulator (not while engine is running).

Start engine - CO content rises.
Connect oxygen sensor - CO content should go back to the nominal value.
Remove clamp from vacuum hose.

** Refer to Specifications

13-00-000 Pre-Cooled Exhaust Valve SPEED AND CO CONTENT (BMW) - Cars with Catalytic Converter

Engines with M 1.3 Motronic

Requirements for All Adjustments

Engine at operating temperature, i.e. oil temperature at least 90 °C

Engine and ignition in perfect operating condition

Connect BMW Service Tester to operating instructions

Routine checking is not necessary

Enter number of cylinders (4) for engine idling speed test step no. 8



SA 11 011 G

Important!

Corrections cannot be carried out on the air volume sensor adjusting screw. For air volume measurements with the potentiometer the adjustment does not have influence on catalytic converter and idling speed regulation in catalytic converter operating mode.

The plug for the CO potentiometer, however, must be disconnected (refer to Gr. 12)



SA 11 011 G

1) Engine Idling Speed

Check engine idling speed**

Refer to BMW Diagnosing System if nominal value is not reached

Check intake system for leaks

Note:

There is no adjusting screw for idling speed adjustments

2) CO Content

Disconnect oxygen sensor plug (not in cars prepared for catalytic converter). Unscrew screw (1). Connect Special Tool 13 0 105 to exhaust manifold. Check idling speed

CO content** Switch exhaust extraction system off for time of test.

Nominal value Not Reached and CO Content Too High:

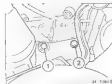
Check:

- fuel injectors,
- fuel pressure and
- coolant temperature sensor

CO Content Too Low:

Check hoses and connections for engine idling speed control and detect air leaks.

** Refer to Specifications on Gr. 11 and 13



SA 13 010 G

Checking Function of Oxygen Sensor (11 70 010)

Unscrew screws (1) and (2).

Connect Special Tools 13 0 105 to exhaust manifold.

Switch exhaust extraction system off for time of test.

Disconnect oxygen sensor plug.

Clamp vacuum hose (not while engine is running).

Start engine - CO content rises.

Connect oxygen sensor - CO content should go back to the nominal value.

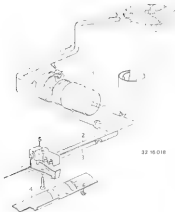
Remove clamp from vacuum hose



SA 13 010 G

13 32 051 REMOVING AND INSTALLING FUEL FILTER

Survey of fuel filter and pipes



33 16 018

- 1 Fuel filter
- 2 Feed pipe
- 3 Return pipe
- 4 Trim panel
- 5 Holder on floor plate



13 32 051 REPLACING FUEL FILTER

Disconnect pipes



Unscrew bolts
Pull off filter



25 12 001

Installation
Check direction of flow (arrow)



K2 41 000 REPLACING IDLE SPEED CONTROL VALVE (M40)

After checking engine idling speed (13 00
004/040) or function of fuel (13 00 000)

Squeeze clip and pull plug (1) off



Loosen hose straps.
Disconnect hoses (2 and 3).



Cut wire straps off



Push idle speed control valve through
the remaining strap and remove.



Installation
Check code (R)
Check idling speed*

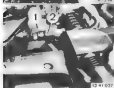


Component Test

Refer to BMW Diagnosing System to
troubleshoot and check electric connection

Electric Test

Measure resistance between terminals (1
and 2).
Specification: 0 - 2 Ω.



13-41-500

13-41-500 Replacing (checking) idle speed control valve (M30, M30)

Disconnect plug (1).
Detach (press together) retaining strap (2).
Pull idle speed control valve from base and remove.

Installation note
Note identification No. (1) %.
Check idle speed %.

Motor
Operation of the idle speed control valve can be felt by touching with the hand (checked work sign supply).



13-41-500

Electrical check

Measure resistance between terminal (1) and (2), setpoint approx. 40 W.
Measure resistance between terminal (2) and (3) or (2) and (3).
Setpoint approx. 30 W.

Removal

Remove idle speed control valve (plug remains connected).
Completely open or close rotary piston (1) by turning valve assembly.
Switch on ignition. Rotary piston must assume a position of approx. 50 % cross section opening and remain in this position.

Test
See BMW DIAGNOSTIC SYSTEM



13-41-004

13-41-500 Replacing idle speed control valve (M50)

Note

When installed, operation of the idle speed control valve can be detected by touching it with the hand (pneumatic voltage supply).



See BMW DIAGNOSTIC SYSTEM



13-41-510

Installation note:

Note identification No. 137
Check idle speed*



13-41-005

Release hose clip

Remove gasket (1)

Disconnect idle hose (2) and hose (3)



13-41-006

Disconnect hot water hose.

Disconnect plug (4).

Unclip hose (5) and remove.



13-41-007

Disconnect vacuum hose (6)

Slide idle speed control valve through retaining strap and remove.

Component Test

Beach test
Double-coil rotary positioner
Three-pin plug

Clicking of the idling speed control valve must be heard and felt when switching the ignition on.
Refer to BMW Diagnosing Systems troubleshooting and check wiring connections.



30 1 201 1

Dynamic Test

Switch ignition on
Remove idling speed control valve (plug remains connected)
Open or close rotary piston (1) completely
Switch ignition on
Rotary piston must move into and remain in a position of approx. 30 % of the cross section opening



30 1 201 1

Electric Test

Measure resistance between terminals (1 and 2).
Specification: $40 \pm 5 \Omega$.
Measure resistance between terminals (2 and 1) or (2 and 3).
Specification: $20 \pm 5 \Omega$ each



30 1 201 1

Disconnect hoses (1 and 2) to replace the spring



30 1 201 1

Siemens MS 40, MS 40.1
Single-coil rotary positioner
Two-pin plug

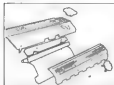
Electric Test
Measure resistance between terminals (1 and 2).
Specification: $20 \pm 5 \Omega$

Mechanical Test

It should be possible to turn rotary piston (1) in the idling speed control valve when the valve is rotated abruptly



30 1 201 1



13 51 630 Replacing fuel pressure regulator (MSO)

Remove covering



Disconnect vacuum hose



Release screw (1)
Press off fuel pressure regulator (2)* sealing rings held fast.

Caution!
Sealing ring drops out

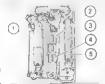


Installation note
Check sealing rings and replace if necessary
Note identification No. and nominal pressure

* Refer to Technical Data



Check
Install pressure gauge 13 5 080 with connection line and T-piece 13 3 004 in fuel supply line (bottom line)



Unplug fuel pump relay (3)
Connect jumper between terminal B7 and terminal 30 with speed of foot 6* 3 050
* "fuel injection pressure"



If the fuel injection pressure* drops too fast, close off return line (upper line) with tool 13 5 010 and briefly operate tool 61 3 050 again.
The pressure regulator is defective if the injection pressure is now maintained.
If the injection pressure drops, there is a leak upstream of the pressure regulator.

* Refer to Technical Data



13 51 030 Replacing fuel pressure regulator (B440)

After function test of digital motor electronics (DME) 13 00 002, or after testing delivery pressure of fuel pump 13 31 000

Disconnect vacuum hose (1)

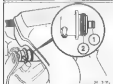


Disconnect hose (2)



Release screw (3). Remove retaining strap

Caution!
Throttle washer drops out.



Turn regulator and pull out.

Insertation note
Replace sealing rings (1) and (2).
Note identification No. and nominal pressure*

* Refer to Technical Data



Component testing
Install B440 or PRINCE TESTER in pressure gauge 13 3 080 with connection line and T-piece 13 3 084 in fuel supply line ahead of pressure regulator



Unplug fuel pump relay (3). Connect jumper between terminal (2) and terminal (3) with special tool 6-1 3 854.
Read off fuel injection pressure*



If the fuel injection pressure* drops at low test rate, close off return line (upper line) with tool 13 3 010 and once again briefly operate tool 6-1 3 854.

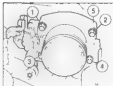
The pressure regulator is defective if the injection pressure is now multiplied.
If the injection pressure drops, there is a leak upstream of the pressure regulator.

* Refer to Technical Data



13-54-000 REMOVING AND INSTALLING THROTTLE VALVE ASSEMBLY (MSD)

Loosen hose strap and pull bottom off



Unscrew screws (1 - 4)
Remove throttle valve assembly

5 = Cover

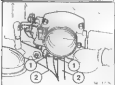


Loosen clamps and remove air volume sensor together with the bellows.



Disconnect cables (1) and if applicable (2)

Inspection
Adjust cables - refer to paragraph Group 35 or 36



Loosen hose straps (1) and push hoses (2) back
Pull plug (3) off of the throttle valve switch

Insulation
Replace gasket (5)



13 54 020 REMOVING AND INSTALLING THROTTLE VALVE ASSEMBLY (MAG)

Unscrew screw (1) and fold plastic cap out of the way



Unscrew screws (2 and 3)



Unclip cable (or cables)
Unscrew screws and remove hose strap (4) and remove bellow (5)



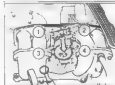
Pull plug off of the throttle valve switch



Unscrew screws (7) and remove preheater
Disconnect hoses (8 and 9)



Preheater
Check for correct seating of the preheater flange seat



Unscrew screws (1 and 2)
Remove throttle valve assembly



Preheater
Replace gasket (6)



13-61 008 REMOVING AND INSTALLING

UNIT

Unscrew screws (1) - (4).

Remove cover.



Pull both (1) up and disconnect plug (2).

Caution!

The plug may only be disconnected or connected with the ignition switched off.



Unscrew mounting screws (2) or pull the control unit out of the spring retainers.
Remove control unit.



Installation

Check code (1)* and production date (2)*

* Refer to Specifications

Important!

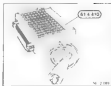
Control units and harness units (13-61 008 11) from control units and they must not be interchanged.

Danger of short circuit!

Plugs are also coded differently

Code and make information is provided on Bosch parts

Refer to 13-61 008 11 for more information on the variety of types and models.



Important!

When using test adapters (13-61 008 11) there could be a mixup between Bosch

test adapters (13-61 008 11) and Bosch test adapters (13-61 008 11).

To avoid a mixup between control units and engine wire harnesses, first check whether the new control unit can be plugged on the engine wire harness.

Test adapters (13-61 008 11) have zero coding and fit both control units even with different coding of the plugs.

Non-conformance could lead to destruction of the (13-61 008 11) control unit and wire harness.



13-62-000 REMOVING AND INSTALLING AIR FLOW SENSOR (MAB)

Twist and pull multiple-pin plug (1) off



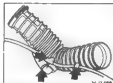
Squeeze the clip and pull the plug off of the cycling valve.
Unscrew screws on the mounting bar



Loosen hose clamp (1).
Pull behind plug



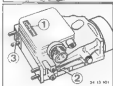
Unlatch clips (2 - 6).
Reattach upper portion of the air cleaner together with the air flow sensor



Installation
Check securing of wires and hose connected pipes



Unscrew nuts



Installation
Check code (17" production date (27" engine (30" speed) and (30" speed CO content)
Replace gasket (2)



13 62 000 REMOVING AND INSTALLING AIR FLOW SENSOR (M00)

Put multiple-pin plug (1) off



Unfasten clips (3 - 6).
Pull upper section of air cleaner out together with the air flow sensor



Unfasten sensor (2)



Unfasten nuts (7 - 10).
Remove air flow sensor



Installation
Check code (1)*, production date (2)*, engine idling speed* and idling speed CO content*
Check air flow sensor*



Wiring Diagram





13-62-000 REMOVING AND INSTALLING AIR FLOW SENSOR (AFS)

Pull multi-pin plug (1) off.
Loosen hose straps (2) and (3).
Disconnect hose (4).



Press clips (1) - (3) off.



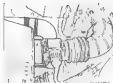
Check and, if necessary, replace stent.
Models (1) - (3).



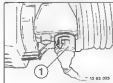
Inspection
Check code (1)*, production date (2)*
engine idling speed* and idling speed CO
content*
Check air flow sensor*



Wiring Diagram



13-82-005



13-82-005



13-82-006



13-82-007

13-82-580 Removing and installing air mass meter (M50, M50 B20 TR)

Caution!

As of 9/91 a new motor electronics system (M540) is phased in on vehicles in Germany (identified by the hot film mass meter with small square plastic cover). The components (e.g. control unit, sensor, sending unit etc.) must not be mixed. For further information, see BMW Diagnostic System Sensors M540 hot film air mass meter.

Bosch (M50)

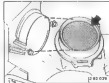
Hot wire air mass meter
Turn multiplug (1) and disconnect

Release hose clip. Remove gasket (2)

Release screws (3 and 4)



13-82-008



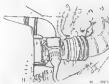
13-82-009

Turn air mass meter and remove

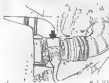
Installation note
Only re-install undamaged screen

Caution!

The new motor electronics system (M540-1) is installed on vehicles with M50 TR 2.0 i engine identified by the hot film air mass meter with small square plastic cover. The components (e.g. control unit, sensor, sending unit etc.) must not be mixed. For further information, refer to BMW Diagnostic System Sensors M540 hot film air mass meter.



13-82-010



13-82-011

Note identification Mo* when replacing air mass meter.
Check idle speed and CO content via BMW DIAGNOSTIC SYSTEM.

* Refer to Technical Data



SA 13107

13-62.580 Removing and installing hot film air mass meter (M50 825 1A)

Turn multiplug (1) and disconnect.
Cut off cable ties.

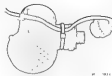


SA 13108



SA 13109

Release screws (3 and 4).
Remove air mass meter.



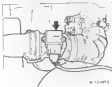
SA 13110

Insulation note:
Secure cable with cable ties.



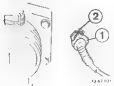
SA 13111

Insulation note:
Only re-install undamaged screen.



SA 13112

Note identification No. when replacing air
mass meter.
Check idle speed and CO content with BMW
DIAGNOSTIC SYSTEM.



13-62 511 REPLACING INTAKE AIR TEMPERATURE SENSOR (M60)

(After checking function of signal and its electronics as in 13-60 562.)

Squeeze the spring and pull off plug (1).
Unscrew temperature sensor (2).

Checking

Refer to BMW Diagnosing System

Component Test

Check resistance value* on the temperature sensor.

Check wires from the control unit plug to the temperature sensor plug for breaks and

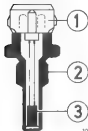
shorts.



Important!

The coding of sender plugs is different for Bosch CMB and Siemens MS 40.

* Refer to Specifications



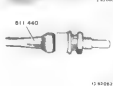
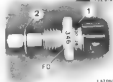
30 13 625

13 62 521 REMOVING AND INSTALLING CHECKING COPLANAR TEMPERATURE SENSOR

After checking function of digital engine electronics as in 13 60 000 .

The temperature sensor measures the engine temperature and sends this information as a resistance value signal to the control unit.
The resistance value falls with rising temperature (NTC).

- 1 = Plug section
- 2 = Housing
- 3 = NTC resistor



Installation

Tightening (44qu)

Press the fuel injector plug half onto each injector.

- (1) Temperature sensor plug = blue
- (2) Temperature gauge plug = black

Removing and installing Disconnect plug (1) Unhook temperature sensor

Installation

Tightening torque*

- (1) Temperature sensor plug = blue
- (2) Temperature gauge plug = black

Application

Check code (1)*

Replace seal (2)

FD = Production Date

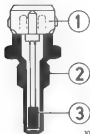
Fit and bleed cooling system - refer to Group 17

Testing

Connect Jetronic test leads 811 440

Check 'initial value' with an ohmmeter to check the entire temperature range. Remove and place the temperature sensor in a water bath. Heat water to setting temperature and measure the resistance* with an ohmmeter.

* Refer to Specifications



30 13 625

13 62 53: PREHEATING AND HEATING, NO CHECKING COOLANT TEMPERATURE SENSOR (MTC)

After checking function of signaling engine electronics see 13 62 000 1

The temperature sensor measures the engine temperature and sends this information as a resistance value signal to the control unit.
The resistance value falls with rising temperature (NTC).

- 1 = Plug connection
- 2 = Housing
- 3 = NTC resistor

Refer to BMW Diagnosing System to check temperature sensor (coolant).



30 13 625



Removing and installing
Disconnect plug (1) with long wire



Unscrew DME temperature sensor (1)



30 13 625

Important

The coding of sender plugs is different for Bosch DME and Siemens DME 40.

Photo 20.14

Lightening tongue*

- (1) Temperature sensor
- (2) Temperature gauge

Maintenance

Check code - 17
Replace seal (2)
FD = Production Data
FIR and bleed cooling system - refer to Group 17

Testing

Check nominal value* with an ohmmeter to check the entire temperature range.
Remove and place the temperature sensor in a water bath. Fill water to testing temperature and measure the resistance* with ohmmeter.

13-64/1

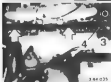


13-64-541 Replacing all fuel injector valves (M20)

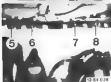
Remove retaining bracket (1)



Disconnect plug-and-socket connection (2)



Disconnect plug (3) for water temperature sensor plug (4). OMS temperature sensor: pull up connector strip and remove



Release retaining screws (5-8), push up injection tube until injector valves move out of guide of intake manifold.
Remove fuel injector valves individually



Installation note:
Check O-rings (1), replace if necessary.
Note identification No. (21).
Observe position of plastic washer (3).
Observe color of plug housing (4) or of new air guard (4).
FD = Production date
Lightly coat O-rings with Vaseline before fitting.

30 13 123

13-64/2

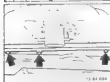


13-64 541 Replacing all fuel injector valves (R00)

Release hose clips (1 and 2).
Remove Probe (2).
Lift out plastic caps (4 and 5).



Release 5 mm Allen screws (1 and 2). Remove connection strip.



Release screws for injection tube (3 screws).



Push injection tube (1) upward until fuel injector valves are out of guide -> rotate manifold.



Disconnect plug (1).
Lift out retainer (2) and remove fuel injector valve.

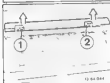


Insulation note
Check O-rings (1) and replace if necessary.
Note identification No. (2)
T.D. = Production date
Observe position of plastic marker (3)
Observe color* of plug housing (4) or of jet guard (5). Lightly coat O-rings with Vaseline or form emulsion oil SAE 90 before fitting.



13-64-041 Removing and installing all fuel injector valves (R400)

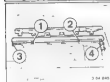
Remove covering



Release screws (1) and (2)
Remove connector strip



Disconnect vacuum hose

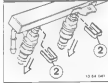


Release screws (1) and (2)
Remove supply line (3) and return line (4)

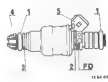


Pull injection tube with valves upward

Installation note:
Check seating rings and replace if necessary
Check fuel line connections for leaks



Lift out return (2) and remove fuel injector valve



Installation note:
Check O-rings (1) and replace if necessary
Note identification No. (2)
FD = Production date
Observe position of plastic housing (3)
Observe color^{*)} oil plug housing (3) for oil guard (4). Lightly coat O-rings with Molykote[®] or equivalent on SAE 90 before fitting.

Clean fuel injector valves, refer to Service Information No. 3-1-87 (823)

^{*)} Refer to Technical Data



13 71 000 REMOVING AND INSTALLING AIR CLEANER

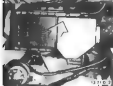
Pull off multiple-pin plug (1)



Loosen hose clamp (2)
Pull off hose (3)



Unscrew nuts (4 and 5)



Pull up and remove air cleaner



13 72 001 REPLACING AIR FILTER CARTRIDGE

At 20
Pull off multiple-pin plug (1)



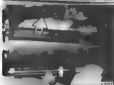
Loosen hose clamp (2)
Pull off hose (3)



Loosen fasteners (4 and 5)
Pull up and turn upper air cleaner section
with air flow sensor



Pull out filter cartridge



13 71 000 REMOVING AND INSTALLING AIR CLEANER

14 30

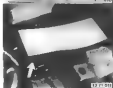
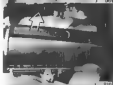
Loosen hose clamp (1)
Pull off hose (2)

Uncover the CD

Remove air cleaner by pulling back and up

WARNING

Quote on intake manifold
Have rubber mounts engage in holders



13 72 001 REPLACING AIR FILTER CARTRIDGE

14 30

Loosen hose clamp (1)
Pull off hose (2)

Loosen fasteners (3) and (4)

Pull up upper air cleaner section

Pull out filter cartridge



13 71 000 REMOVING AND INSTALLING AIR CLEANER (M 50)

Loosen hose clamp (1).
Pull off dust cover.
Turn and pull off plug (2).



Unscrew nuts (3 and 4).



Pull out air cleaner with air mass sensor back from above.



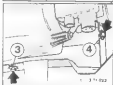
Disconnect cooling air hose.

Insertion
Guide in intake neck.
Here rubber mounts engage in holders.



13 72 001 REPLACING AIR FILTER CARTRIDGE (M 50)

Loosen hose clamp (1).
Pull off dust cover.



Unscrew nuts (3 and 4).
Pull up and push back air cleaner housing slightly.

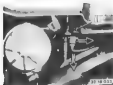


Open fasteners (5 and 6).



Pull air cleaner housing sections apart.
Pull out air filter cartridge.

13-90/1



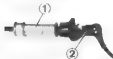
13-90-000 REPLACING TANK VAPOR VENTING VALVE (M05 + M06)

(After checking function of digital engine electronics at 13-00-000.)

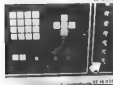
Unscrew retainer
Pull off plug
Unscrew screw (1).



Pull off hoses
Unscrew tank vapor venting valve.



If Applicable, Checking:
Connect vacuum hose (1) to 8 mm dia. adapter.
Supply 12 V voltage to tank vapor venting valve using Special Tool 99-1-440 (2).



Select Multimeter Function 21 on BMW Service Tester
Set vacuum to 500 + 100 mbar
Then switch off tester.

Vacuum must not drop by more than 50 mbar during the testing time of about 20 seconds.
Replace tank vapor venting valve if the vacuum drop is greater than 50 mbar.

13 Fuel system

M5

13 00 60	Engine idle speed and CO content (S38 B35/B36) – check	13-	0/1
	Exhaust gas synchronization (S38 B35/B36)	13-	0/2
13 00 60	Engine idle speed and CO content (S38 B38) – check	13-	0/3
	Exhaust gas synchronization (S38 B38)	13-	0/4
	Non-return valves in idle air rail (S38 B38) – check	13-	0/6
13 31 029	Delivery pressure of fuel pump – check	13-	31/1
	Fuel delivery quantity – check	13-	31/1
	Fuel pump – remove and install	13-	31/1
13 41 500	Idle speed control valve – remove and install or check	13-	41/1
13 51 630	Fuel pressure regulator – remove and install	13-	51/1
13 54 030	Throttle assembly – remove and install, seal	13-	54/1
	Basic throttle setting	13-	54/3
	Hose layout diagram (for mixture control) S38 B36	13-	54/6
	Resonance control – check	13-	54/7
13 62 560	Air mass meter – remove and install or replace	13-	62/1
531	Coolant temperature sensor – remove and install or check	13-	62/2
511	Air temperature sensor – remove and install	13-	62/2
13 63 544	Throttle switch – adjust	13-	63/1
511	Throttle switch – remove and install	13-	63/1
13 64 541	Fuel injector valves: all – remove and install or replace	13-	64/1
13 71 000	Air cleaner – remove and install	13-	71/1
13 72 001	Air cleaner cartridge – replace	13-	71/1

For further information on troubleshooting and jobs in assembly 13 refer to:
 Microfiche Assembly Repair Manual and
 Electrical Troubleshooting Manual 5 Series E34

13 00 040 Checking engine idle speed and CO content 338 835-036

Preconditions for all setting work:
Engine is at operating temperature, i.e. over oil temperature 60 °C
Valve clearance correct. Engine and ignition system in technically perfect condition
Air conditioning system off
Connect BMW SERVICE TESTER in accordance with operating instructions
A routine check is not necessary

1) Engine idle speed

Check engine idle speed ¹⁾
Check intake system for leaks
If the specified setpoint is not reached, use BMW Diagnostic System. Check function of idle speed control valve 13 01 150



¹⁾ There is no adjusting screw for idle control

2) Behaviour on road test

Disconnect plug-and-socket connection of oxygen sensor
Remove screws
Caution! They are very hot!
Connect exhaust gas probes 13 0 110 to take-off pipes

Check idle CO content
Switch off intake system for duration of measurement

If the specified setpoint is not reached

If CO value too high

Check injection nozzles

Fuel pressure

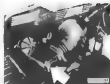
Water temperature sensor

If CO value too low

Check hoses and connections for idle speed control and intake leakage on

Exhaust emission specification must be carried out if the difference between the individual take-off points is greater than 0.2 vol. %

¹⁾ Refer to Technical Data



Caution!

The setting of the air intake system must not be changed with the adjusting screw

Note

Check spark plugs after long idling period

Check function of oxygen sensor (13 0 010)

Release screws

Caution!

They are very hot!
Connect exhaust emission probes 13 0 110 to take-off pipe

Switch off intake system for duration of exhaust emission measurement

Disconnect plug from oxygen sensor

Close off vacuum hose to fuel pressure regulator (not with engine running), start engine

CO value increases. Connect oxygen sensor

CO value must drop to specified setpoint¹⁾

Remove caps



3 47 011



¹⁾ Refer to Technical Data

Exhaust synchronization \$36836-836

During routine service work, there is no need to conduct a thorough test or exhaust synchronization test.

Synchronization is only required during repair work or if a complaint has been received (e.g. rough idle).

**Engine without individual exhaust gas extraction points**

Precautions: pressure not setting plug (see removing and installing throttle valve spigot 13 54 000)

Remove seal caps (1). Connect up vacuum measuring unit (MANA CO RV002 TESTER M 2). Measure suction pipe vacuum at all 6 throttle valve spigots and note down results. Leave testing caps (1) on the throttle valve spigots which are not to be measured.

With screw (2) (socket 7 mm WAF), set entry throttle valve spigot to the same vacuum level as 380 - 50 mbar at nominal idling speed. Vacuum difference max. 3 mbar.

If new longer-piston device (2) enter adjustment has been successfully completed. Then check engine idle speed* and CO output*.

**Engine with individual gas extraction points**
Precautions: pressure not setting plug (see removing and installing throttle valve spigot 13 54 000)

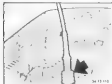
Measure and compare CO values at the extraction points.

Disconnect oxygen sensor plug.

With screw (2) (socket 7 mm WAF), check CO nominal value ± 0.8 - 0.4 vol. %. Max. permitted deviation between the cylinders ± 0.2 vol. %.

Connect up Lambda oxygen sensor plug.

Refer to Specifications



13 00 090 Check engine idle speed and exhaust contents 534658

Requirements for all adjustments:

Engine is at operating temperature. i.e. oil temperature is min. 80°C

Valve clearance is correct. Engine and ignition system in good working order

Air conditioning system switched off

Connect BSR Service Tester to operating instructions

Routine checking is not necessary

1) Engine idle speed

Check engine idle speed*

Caution: If the TSC signal on the diagram plug (pin 1) is not allocated, use adapter set 12 7 040

Refer to 12 7 13

If engine idles unevenly, check air intake system for leaks

If nominal value is not achieved, interrogate fault memory with BSR Diagnosis System. Call up adaptation values. Use diagnostic kit-kette from 11 0.

Perform function check on idle regulation valve 13 0 000.

0000

There is no adjusting screw for idling speed regulation.

2) Exhaust test

Lambda oxygen sensor remains connected.

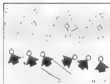
Unscrew bolts.

Caution: These get very hot

Connect exhaust sensors 13 0 110 to extraction pipes.

Check the CO content* at idle speed.

* Refer to Specifications



If nominal value is not achieved with excessive CO value, check injection nozzles, fuel pressure, water temperature sensor

If CO value is too low

Check hoses and connections for idle governing and pre-purge air leak

If the difference between the individual extraction points exceeds +0.2 vol%, an exhaust synchronization test must be performed

Caution:

Do not adjust the mass air flow sensor adjusting screw

Note:

After extended period at idle speed, check spark plugs.



Perform function check on Lambda oxygen sensor (11 78 810)

Unscrew bolts.

Caution: These get very hot

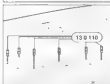
Connect exhaust sensors 13 0 110 to extraction pipes

Disconnect oxygen sensor plug

Clamp vacuum pipe to fuel pressure regulator (not while engine is running), start engine, CO value rises

Connect oxygen sensor - CO value must return to nominal value*

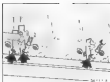
Remove clip



* Refer to Specifications

Exhaust synchronization test 538938

During routine service work, there is no need to conduct a vacuum test or exhaust synchronization test.
Synchronization is only required during repair work or if a complaint has been received (e.g. rough idle).



Injection of throttle valve lipophilic oil
Tuck paper strip between 3 detent screws and the lipophilic detents. Pull on paper. If it is easy to remove the paper, perform a basic setting operation (see Removing and Installing Throttle Valve Spigot 13 04 030).

If none of the paper strips can be extracted easily, perform vacuum test on throttle valves. Remove seal caps (7). Connect up vacuum measuring unit (DME) SERVICE TESTER M (7). Measure suction pipe vacuum at all 6 throttle valve spigots and note down results. Note: Leave sealing caps (7) on the throttle valve spigots which are not to be measured.

Suction pipe vacuum 300 - 50 mbar. If values deviate, perform a throttle valve basic setting operation (see Removing and Installing Throttle Valves 13 04 030).



Unscrew bolts.
Caution! These get very hot.
Connect exhaust sensors 13 0 110 to exhaust sensor pipes.
Measure and compare CO values* at the extraction points.

Caution
Lambda oxygen sensor remains connected up

If the difference at the individual extraction points is greater than 0.2 vol. % remove lamp protection. Adjust CO nominal value* with bypass screw (2 socket 7 mm width).

If there is a large deviation, screw all 6 bypass screws firmly home. (Disconnect ignition system from (24) control unit for 2 minutes. (Reset adaption values).

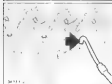
Measure CO values from cylinders 1 - 6 again and note down values. The bypass screw from cylinder with the lowest CO value does not change throughout the entire synchronization period. This value is raised when the other cylinders are adjusted.

* Refer to Specifications



Gradually adjust the CO values of the other cylinders in small steps (max. 1-4 turns of the fly-pass screw)

Finally, conduct trial run for 15 mins at part throttle and run engine at idle speed for 10 minutes.



Caution! Keep repeating control check on other cylinders since all cylinders affect each other reciprocally

Note:
After extended period at idle speed, check spark plugs

Then: check adaption values and interrogate or clear fault memory. Refer to BMW diagnostics system



If 1) new lamp protection 2) once adjustment process has been completed.



Check non-return valves in idle air strip 536536.

Disconnect accelerator cables.
Remove rubber mounts.



Loosen hose clamps (3 and 4).
Remove suction hose.



Detach idle valve (1) from all 8 throttle valve apertures.



Loosen hose clamps.
Remove idle hose (6), vent hose (4) and oil return hose (7).



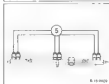
Detach idle valve (3) from air separator.
Remove air manifold.
Take care of vacuum hoses.



Remove idle speed control valve and close aperture (2). Disconnect hoses (3 and 4) or remove and seal apertures.



Remove vacuum hose (1) from fuel pressure regulator and connect up to BMW Service Test unit.



Measure vacuum with multimeter program (M27). Nominal value approx. 600 mbar. If the measured value greatly exceeds this, or if it falls very rapidly when the pump is switched off, remove idle strip and its non-return valves (5).



13 31 063



13 31 070

13 31 026 Checking delivery pressure of fuel pump

Install pressure gauge 13 3 050 with connection line and T-piece 13 3 064 in fuel supply line - upper line -
Connect fuel line to tool 13 3 016 after the T-piece.

Remove lid of control unit box. Unplug fuel pump relay (1).
Connect jumper between terminal 87 and terminal 30 with tool 61 3 006.
Check delivery pressure.



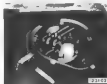
13 31 081



13 31 - Checking fuel delivery rate

In order to also check the pressure build-up, measure the delivery rate after the pressure regulator.
Release fuel return line - bottom line - (island with plastic hose and glass in measuring glass 13 3 000).

Remove lid from control unit box.
Unplug fuel pump relay.
Connect jumper between terminal 87 and terminal 30 with tool 61 3 006.
Check delivery quantity*.



13 31 - Removing and installing fuel pump

Remove and install fuel level sending unit and in-tank pump (M20)** refer to 16 12 000.

* Refer to Technical Data Group 10

** Refer to Technical Data Group 10

** Refer to Assembly 10



13-41-000 Removing and installing / checking idle speed control valve

Note

When installed, operation of the idle speed control valve can be checked by touching with the finger (checked voltage supply).

The electrical test can also be carried out at the intermediate connector with the valve removed.

Remove idle speed control valve.
Remove manifold relay to.
Removing and installing throttle body
13-54-000.



13-41-002



13-41-003

Installation note
Note identification No. (1)*
Check idle speed*

Electrical check

Measure resistance between terminal (1) and (3), set points approx. 40 Ohm.
Measure resistance between terminal (2) and (1) or (3) and (3).
Setpoints approx. 20 Ohm.

Dynamic check

Remove idle speed control valve for this purpose (plug remains connected).
Fully open or close rotary piston (1).
Switch on ignition.
Rotary piston must rotate and maintain a set ring of approx. 50 % cross section opening.



13-41-004



13-41-005

Disconnect plug (1).
Detach (press together) retaining strap (2).
Remove hose clips.
Pull idle speed control valve from hoses and remove.



13 51 839 Removing and installing fuel pressure regulator

Disconnected vacuum hose



Release screw (1)
Pull off fuel pressure regulator
(30N: seating rings hard test.)



Installation note
Check sealing rings (2 and 3) and replace if necessary



13 51 031

Installation note
Note identification No. and nominal pressure*

* Refer to Technical Data



13 51 080



13 51 036

Checking
Install pressure (page 13 51 080) with connection line and T-piece 13 51 094 in fuel supply line (upper line) after damper

Unplug fuel pump relay
Connect jumper between terminal 87 and terminal 30 with tool 61 2 090
"Check fuel injection pressure"
Note
If the injection pressure is too high, the pressure regulator is defective or the return line is blocked



13 51 082

If the fuel injection pressure* drops at too fast a rate, close off return line - bottom line - with tool 13 51 015 and once again briefly separate tool 61 2 090

The pressure regulator is defective if the injection pressure is now maintained
If the injection pressure drops, there is a leak upstream of the pressure regulator

* Refer to Technical Data



13-54 030 Removing and installing throttle valve spigot

Disconnect accelerator cables.
Remove rubber mounts.



Unfasten hose clips (3).
Remove suction hose.



Unfasten nuts (1) from all 6 throttle valve spigots.



Loosen hose clamps.
Remove idle hose (11), vent hose (14) and oil return hose (17).



Unfasten nuts (8) and (9) from oil separator.

Take care of vacuum hoses.



Inspect idle instructions.
Before pressing on manifold, fit bolts (8) and (9) to the support.
Partially fit vacuum hoses.



Check O-rings (1) and replace if necessary.
Check gaskets and hoses, replacing if required.
Replace hose clips if necessary.

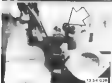


Remove plug early from the injection valves.

Injection system pipe mounting (1 and 2).
Remove delivery lead (3) and return lead (4).



Installation instructions:
Check, replace sealing rings.
Check leads for leakage.



Retracts intermediate plug for idling speed control valve.
Remove vacuum hoses and idling speed hoses.



508038: Disconnect cable and remove idling air stop.

Note:
Check non-return valves, see 13-50



13-54/039

Remove injection tube together with injection valves.

Installation instructions:
Check, replace sealing rings.
Check that sealing rings are correctly seated.



13-54/039

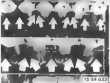
Put off vacuum hoses.

Installation instruction
5-268.26: see flow circuit diagram.



13-54/039

Unlabeled 8 WAF 10 nuts



13-54/039

Unlabeled 8 WAF 13 nuts



Tighten connecting screws (1)

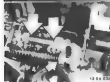


Remove throttle valve shims (2 - 4)

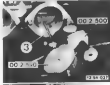


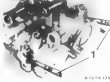
Remove throttle valve assembly

Insulation instruction
Reignite gas jet


Remove connecting tubes
Split throttle valve assembly
Check - replace O-rings on connecting tubes

Note:
The shaft is guided on needle bearings.
Do not drive shaft through bearing while dry.
Do not damage shaft with tool (pliers).
This could damage the needle bearings.


Basic setting of throttle valve
Throttle valve shims removed.
Adjust idle detent
Loosen nut (5).
Rotate idle stop screw (1) in direction of arrow
until the throttle valve is fully closed.
Tighten nut (5) gently

Fit dial gauge (0.2 mm) (with extension 3) and bracket (0.3 mm) to the throttle valve assembly
Dial tip rests under preload against shims
possible point of throttle valve

Loosen nut (5).
Screw in idle detent screw (1) until the throttle valve can just turn and no more. Adjust lower edge of throttle valve by (0.1 - 0.05 mm) (gap) - 1.10 of a turn.
Fit lock nut in idle detent screw (1) and seal with paint

Check seal or gap
With throttle valve closed and at room temperature (approx. + 20° C), it must be easy to insert a feeler gauge (3) blade (0.2 mm) down the left and right sides between a slanting ring (throttle lever) and housing (both sides of the same time).
Check ease-of-movement of throttle valve at operating temperature.



Adjust throttle valve lever position (500)
 Levers (1) and (2) must be flush with one another.
 Correct by adjusting the clamping piece (3).
 Tighten screw and nut (4).



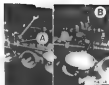
Loosen throttle valve switch
 Do not adjust throttle valve switch until the throttle valve lever position has been adjusted.
 Adjust push rod.
 Set push rod (cylinders 3 and 6) to
 $1 = 87 \pm 0.4$ mm and install.



Set push rods on cylinders 1 and 2, 3 and 4 respectively to a distance of approx. 86 mm.



Fit clamping components (5) once the push rods have been connected.



Secure dial gage (002 540) with indexing (002 500) to stud bolt.

Fit dial gage to lever (1) with pointed. Shorten each push rod (4 and 5) in turn until the dial gage needle starts to move. In the position all 3 throttle levers abut against the idle speed detents.



Set full throttle detent
 Move cable lever (1) to full throttle position. Use a slide gage to check dimension (A) or (B) and note down result.
 Calculate the mean value of the 6 throttle bodies and determine the deviation from the design dimension.
 Using screw (2), adjust all 6 throttle valves simultaneously towards the design dimension.



Dimension A = 21.7 mm (design dimension)



Dimension B = 22.7 mm (design dimension)



Adjust position of throttle valve lever (13-54-01)
 Levers 1 and 2 must be aligned and push 3.
 Correct by adjusting the clamping pieces 4.
 Tighten screws and nut 5.



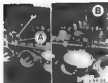
Adjust push rod
 Adjust push rod to cylinders 5 and 6 to
 5 ± 0.05 (0.4 mm) and install.



Adjust push rods on cylinders 1 and 2. 3 and 4 respectively to a distance of 90 ± 0.5 mm



Fit clamping components (6) after the push rods are adjusted



Inspect push rods and shorten consecutively until all 6 throttle levers contact the idle speed detent.



Measure cable lever (1) to full throttle position
 Use a slide gauge to check dimension (A) or (B) and note down result.
 Calculate the mean value of the 6 throttle bodies and determine the deviation from the design dimension.
 Use the screw (2) to adjust all 6 throttle valves simultaneously towards the design dimension.

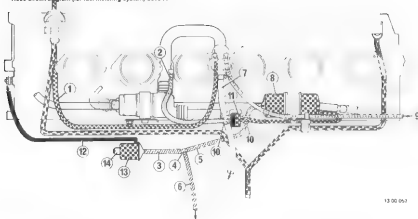


Dimension A = 25.75 mm (design dimension)



Dimension B = 24.75 mm (design dimension)

Hose circuit diagram (for fuel metering system) 538B36



13 00 05-3

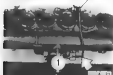
- 1 Vacuum hose to fuel pressure regulator
- 2 Vacuum hose to non-return valve
- 3 Vacuum hose to non-return valve (12)
- 4 T-piece
- 5 Vacuum hose to vacuum tank (8)
- 6 Vacuum hose from T-piece (4) to changeover valve for resonance control

- 7 Suction lead from cycle valve to intake spool
- 8 Vacuum tank
- 9 Vacuum hose to heating regulator
- 10 Vacuum hose from vacuum tank (8) to non-return valve (11)
- 11 Non-return valve
- 12 Vacuum lead to shut-off valve for air intake
- 13 Changeover valve for air intake
- 14 Plug connection (2 pin) on changeover valve (to DME control unit)



Check resonance control unit:

After an engine start, the valve should close briefly - visible by the movement of the linkage.
If necessary, check the vacuum hoses, vacuum unit or changeover valve.



Check changeover valve:

After a cold start, the changeover valve (1) responds briefly.



Check control unit for resonance control (in the control unit box):

After ignition (1), operating voltage + is supplied to changeover valve. After the engine switch (2) is on, the changeover valve receives a brief negative change (3) from the control unit (3).

Butterfly system with resonance charging



Resonance control of unit with active full throttle switch

- 1 = R valve closed
- 2 = R valve open
- 3 = Engine speed in rpm



13 62 680 Removing and installing or replacing air mass meter

Remove air cleaner 13 71 000.
Open clips (5 - 6).



Installation note
Only re-install undamaged screen.
Check that sealing ring is fitted correctly.



Disconnect filter housing.
Detach intake air duct.

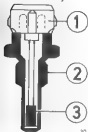
Installation note
Fit inclined section of intake air duct such that the largest possible distance to the filter housing is maintained all round.
Completely press in intake air duct.



Release screws (1 and 2).



Remove air mass meter.



30 13 625

13 62 531 Removing and installing checking coolant temperature sensor

The temperature sensor measures engine temperature and communicates this to the control unit as a resistance value.

Resistance drops with rising temperature (NTC).

1 Plug connection

2 Housing

3 NTC resistance

Temperature sensor (water, air)
Test: see BMW diagnostic system



13 62 531

Removing and installing:
Remove plug (1 blue and 2 black)



13 62 531

Unscrew and remove BMW temperature sensor
(2)



13 62 531

Note: unlightening torque*

(1) Temperature sensor plug = blue
(2) Remote thermometer plug = black

Installation instructions

Note: Gas, No. 117

FD = production date

Fill and bleed cooling system
for 117

Check normal value with ohmmeter*

To check the entire temperature range,
remove temperature sensor. Heat up to test
temperature in water bath and check using
ohmmeter*

13 62 511 Removing and installing air temperature sensor

Removing and installing custom filter housing
13 71 000

Unscrew temperature sensor (2)

* Refer to Specifications



13 63 544 Adjusting throttle valve

Also refer to electric queries in the BMW S&S2

Check throttle valve switch when the throttle cable is closed, value recorded between connections 5 and 4 should be virtually 0 ohms.

When the throttle valve is fully open, the value should be virtually 0 ohms.



13 63 551 Removing and installing throttle valve switch

- Remove multiple plug (2)
- Unscrew bolts (1)
- Remove throttle valve switch (3)

Installation instruction
Check code (1)
Adjust throttle valve switch 13 63 544



Adjustment

When the throttle valve is closed, the value recorded between connections 5 and 4 should be virtually 0 ohms.

Adjust by loosening the screws (1) and resetting the throttle valve switch. After adjustment is completed, open throttle valve - resistance value should rise straight back to 0 ohms. When the throttle valve is released, the repeat value should drop back to virtually 0 ohms.

These values can also be measured using the control unit plug together with the universal adapter**

- LL (6) = 80 on the adapter
- VL (3) = 50 on the adapter
- Ground (4) = 10 on the adapter

LL = idling speed
VL = full throttle

** Sourcing Reference HWB

* Refer to Spec Positions



13-64-541 Removing and installing or replacing all fuel injector valves

Designated plug connector for idle speed control valve



Remove connector wires



Disconnect vacuum hose



Release screws (1 and 2)
Remove supply line (3) and return line (4)

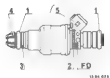


Remove ignition coils with valves by pulling upward

Check, bearing rings and replace if necessary
Check fuel line connections for leaks



Lift out receiver (7) and remove fuel injector



Installation note
Check O-rings (1) and replace if necessary
Note identification No. (2)
FD = Production date
Observe position of plastic washer (3)
Observe color of plug housing (4) or of oil guard (5)
Close O-rings with transverse or transverse pin (54) (55) before testing

Clean fuel injector valves, refer to Service Information for 2 + 11 (622)



13 71 000 Removing and installing suction filter housing

Unfasten hose clip (1)
Pull off hose
Pull on plug (2)



13 71 001

Unfasten screws (3 and 4)



13 71 002

Remove filter housing with air mass sensor at rear by lifting upwards



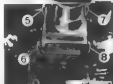
13 71 003

Remove plug (5)
Reposition instructions
Insert suction pipe
Allow rubber mount to engage in bracket



13 72 001 Replacing air cleaner filter

Unfasten screws (3 and 4)
Raise filter housing and slide slightly back



13 72 002

Open clips (5 and 6)



13 72 003

Deflume air filter housing



13 72 004

Pull out filter element

13 Fuel system

524d (M21), 524td (M21)

	Notes	13- 00/21
13-00 050	Engine idle speed – check	13- 00/22
	Layout of electronically controlled injection pump for DDE	13- 00/23
13-32	Layout of fuel filters	13- 32/21
050	Water trap in fuel filter – drain	13- 32/21
051	Fuel filter – replace	13- 32/1
13-51 000	Injection pump – remove and install	13- 51/21
	Installation	13- 51/23
005	Injection pump – adjust statically	13- 51/25
290	Pressure valves – replace	13- 51/26
300	Electric fuel cutout – check	13- 51/27
301	Electric fuel cutout – replace	13- 51/28
320	Fuel system – bleed	13- 51/29
13-53 320	Fuel injector combination – remove and install	13- 53/21
13-61 000	Control units – remove and install	13- 61/21
13-71 000	Air cleaner – remove and install	13- 71/21
13-72 001	Air cleaner cartridge – replace	13- 71/21

For further information on troubleshooting and jobs in assembly 13 refer to
Microfiche Assembly Repair Manual and
Electrical Troubleshooting Manual 5 Series E34

WORKING INSTRUCTIONS**on Reference to Cleanliness on Fuel Systems**

- Clean area around point of repair thoroughly prior to disconnection of pipes/hoses, switches, etc.

Always place removed parts on a clean surface and cover with plastic sheets - never use cloths, floor mat!

Cover or insert plugs in open ends of pipes or hoses and openings in components immediately after work with compressed air

- Only install cleaned parts.
Take new parts out of their packaging only immediately before installation

Keep diesel fuel off of cooled hoses - if applicable, rinse off with water immediately

EXPLANATION OF ABBREVIATIONS

DDE	Digital Diesel Electronics
MUS	Fuel Volume / Combustion Air / Road Speed
SB	Injection Begin Related
ME	Fuel Volume Related



13 00 000 CHECKING ENGINE IDLE SPEED

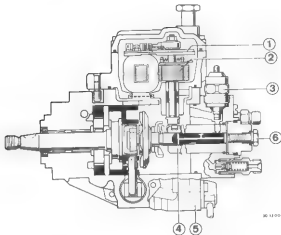
Requirements:

- Engine at operating temperature, i.e. oil temperature at least 80° C (180° F)
- Valve clearance correct
- All electric consumers switched off*

Read engine idle speed* from tachometer in the instrument cluster

- If value deviates from nominal value, read out fault memory of DDE left diagram
- If applicable, check basic adjustment of petrol valve system

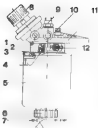
DRAWING OF ELECTRONIC FUEL INJECTION PUMP FOR GDE



- 1 Control valve travel sender
Potentiometer for feedback voltage
- 2 Drive for injection rate rotary magnet
- 3 Electric shutoff
- 4 Control valve
- 5 Splined for injection begin
- 6 Plug for high pressure chamber
(for static adjustment with dial gear)

13 32 000 Fuel Filter

Note:
Fuel filter testing is described in Group 12



- 1 Seal
- 2 Heating element
- 3 Seal
- 4 Heating element mounting nut
- 5 Filter cartridge
- 6 Cap
- 7 Drain valve
- 8 Manual pump
- 9 Temperature switch 5.5°C (42°F)
- 10 Bleeder screw
- 11 Filter head
- 12 Electric connection for heating element



DOE 13 32 000 DRAINING WATER TRAP IN FUEL FILTER

Shower bleeder screw (10)
Push up drain valve (7) and drain until pure clear fuel runs out

Unlock cap of manual pump (8) turn 90° and pump as long, until clear fuel runs out of bleeder screw (10)
Tighten bleeder screw (10)
Lock cap of manual pump (8)



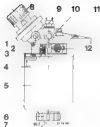
Unscrew bleeder screw (10) and drain a small amount of diesel fuel at drain valve (7).

Unscrew filter cartridge (5) using a standard tool.

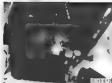
Mount cap (8) and drain valve (7) on new filter.

21-19-172

Unlock cap of manual pump (8) by turning 90° and pump as long, until diesel fuel runs out of bleeder screw (10).
Tighten bleeder screw (10).
Lock manual pump (8).



- 1 Seal
- 2 Heating element
- 3 Seal
- 4 Heating element mounting nut
- 5 Filter cartridge
- 6 Cap
- 7 Drain valve
- 8 Manual pump
- 9 Temperature switch 5.5° C (42° F)
- 10 Bleeder screw
- 11 Filter head
- 12 Heating element electrical connection



13-51 000 REMOVING AND INSTALLING INJECTION PUMP

Removing
Disconnect battery ground lead.

Important!
Interrogate fault memories of all systems, first, on disconnecting the battery **before** them.

Precaution
Fill with coolant* and bleed cooling system, refer to 17 00 000.

Disconnect coolant hoses.
Loosen and remove alternator drive belt.

Installation
Adjust drive belt tensions.



Turn crankshaft to TDC mark (ignition position) (see 16 cylinder no. 1).

Unscrew locked belt guard.



Loosen holder for wiring.



Unscrew oil pipe holder.



Pull off leak oil hose (1).
Unscrew return pipe (2).
Coupling (2) is refilled with injection **oil**.

Installation
Replace & removed leak oil hose.



Unscrew spacing holder of injection pump
 Unscrew all coupling nuts on injection pump
 Plug openings in injection bodies in its caps
 (Caution)
 Apply tool carefully to avoid bending the injection pump

Unscrew coupling nuts on injection pump and pull back probe
 Plug openings with caps

Unscrew connection for fuel pump

Disconnect and harness



Counterhold on adapter and unscrew pipe in the Special Tool 13 5 020
 Plug opening with a cap



Unscrew nut on toothed belt sprocket
 Hold sprocket in the Special Tool 13 5 040



Bolt Special Tools 13 5 061 and 13 5 010 on toothed belt sprocket
 Loosen bolts (see arrow) completely



Turn sprocket further until special tool can be locked
 Use M 6 x 20 mm bolts



Unscrew nuts (1 and 2)



Remove belts (3 - 5)



Push out the injection pump toward the rear with a pulling tool. Turn back the bolt again completely afterwards.



Put wire connector out of holder. Remove injection pump pump. Disconnect plug of Magnetic Valve cable.



21 12 828



21 12 828

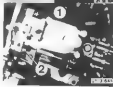


Installation

Transfer attachments, see 13 01 801. Loosen bolt (2 - 4) prior to installation.

Move the injection pump shaft to installed position with special tool 13 01 803. The turning lever must be vertical before the cam. (Perception resistance by turning the lever.)

Insert injection pump being careful that the woodruff key does not fall out.



Tighten nuts (1 - 3) only finger tight at this stage.



Tighten hooker (B) and bolt (F).

Remove Special Tool 13 5 010 and 13 5 061.
Tighten toothed belt sprocket nut. Counterhold with Special Tool 13 5 346. Tightening torque*

Adjust injection pump manually - see 13 51 099.

Mount injection pipes, beginning the tightening at connection (4).
After finishing installation, bleed fuel system - see 13 51 325 and check idle speed - see 13 00 069 in Construction Group Repair Injection.
Check pipes for cylinders 1, 6, 3, 8, 2, 4 in firing order.

* See Specifications.



000 13 51 000 ADJUSTING INJECTION PUMP STATICALLY

Coolant temperature $\geq 20^{\circ}\text{C}$

Unscrew plug (1)

Important!
Always replace seal
Tightening torque*



Screw in Special Tool 13 5 330
Apply dial gage with preload



Turn crankshaft clockwise in direction of
100% in cylinder no. 1 (about 60 to 80° be-
fore beginning) until gage needle remains
at deepest point for some time
Set scale of dial gage to zero



Pull out plug (2)
Turn crankshaft clockwise until Special
Tool 11 3 300 engages in bore in flywheel
at 0°

Important!
Do not turn opposite engine's direction of
rotation - wrong test results.



Read travel of distributor plunger on dial
gage
Test value: $1.00 \pm 0.02\text{ mm}$



Adjusting

Tighten screws (3 and 4)



Loosen nuts (1 and 2) — do not loosen too
much to avoid tension from the locked
drive belt



Run injection pump until dial gage displays
the correct value*
Tighten nuts in sequence of 1 to 4.
Tightening torque*
Recheck adjustment

* Refer to Specifications

* Refer to Specifications

13-51 150 REPLACING PRESSURE VALVES

The pressure valve closes the injection pipe to the pump. It has the task of taking pressure off of the injection pipe after completion of the delivery phase by releasing a defined volume of the injection pressure.

- 1 Valve center
- 2 Valve plunger - valve seal
- 3 Valve spring
- 4 Pressure valve holder
- 5 Injection pipe connection



1 2 3 4

31 10 004



Disconnect battery ground lead.

Important!
Deactivate fault memories of all systems first as disconnecting the battery will erase them.

Disconnect hose.

Unscrew oil flap (2).

Remove injection pipes from injection hoses using Special Tool 13-8-030. Install protective caps.

Installation
Tightening torque = 90 to 95 Nm.

Unscrew spacing holders (3).



13-51-200 CHECKING ELECTRIC FUEL SHUTOFF

The shutoff receives power supply from the control unit from ignition key position **DRIVE** on. A loud click will be heard to indicate this.

Check power supply to the control unit. If a click is not heard, see self-diagnosis for other tests.

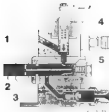
If applicable, check master relay

- 1 Master relay (fuel)
- 2 Fuel filter (feeding relay (strangle))

13-51-20* REPLACING ELECTRIC FUEL SHUT-OFF

The diesel engine is stopped by interrupting the supply of diesel fuel. The shut-off restricts power supply from operator key position DRIVE to:

- 1 Fuel line
- 2 Distributor inlet
- 3 Distributor head
- 4 Magnet
- 5 High pressure chamber



Attention:
Disconnect leads on fuel shut-off

Unscrew fuel shut-off with a 24 mm open-end wrench.

Caution!

Watch out for piston and spring - they could fall out.

Piston is moved out by force of spring when without current - fuel feed is interrupted.

Warning:

Check O-ring for correct seating.

Tightening torque = 20 ± 5 Nm (14.5 ± 3.5

ft. lbs.)



DOE **13-51-326 BLEEDING FUEL SYSTEM**

The fuel system (13-51-326) does not have to be bled, since the fuel transfer pump builds up pressure in the feed pipes in operation (3').



Bleeding Injection Pump

Loosen plug two turns.

Crank engine with the starter until diesel fuel runs out - then tighten plug again.

Tightening torque = 14 + 6 Nm (10 + 4 ft. lbs.)

Bleeding Injection Pipes

Loosen all coupling nuts on injection nozzles with Special Tool 13-9-020

Crank engine with the starter until diesel fuel runs out of the pipes - then tighten nuts again.

Tightening torque = 20 + 5 Nm (14.5 + 3.5

ft. lbs.)



13 5 320 REMOVING AND INSTALLING INJECTION NOZZLE ASST

Loosen hose clamps.
Disconnect intake air hose

Uncrew oil trap



Loosen and remove pipe spacing holders.
Pull off leak oil hoses using a pliers.

Installation

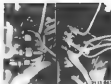
Replace leak oil hoses after removal.



Uncrew couplings using Special Tool
13 5 020.

Note

Reposition tool in good time to prevent
bending pipes.
Plug openings with protective caps.



Uncrew coupling on injection pump
If necessary, disconnect air pressure
valve.

Installation

Tightening torque*

Uncrew injection nozzle using Special
Tool 13 5 320.

Installation

Bleed injection pipes - refer to 13 5 320.
Refer to Group 15 in Construction Group
Repair Manual for additional information.

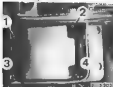
Components of Injection Nozzle Assembly

- 1 Nozzle holder
- 2 Nozzle body
- 3 Feed bore
- 4 
- 5 Nozzle pinhole
- 6 Leak oil pipe

Important!

The injection nozzle with pinhole movement
sensor (pin) for cylinder no. 4 must never


* Refer to Specifications



13-61 000 REMOVING AND INSTALLING CONTROL UNITS

Unthread screws (1) - (4).
Lift cover off of electronic base.



Caution:
Turn off ignition before disconnecting or connecting multiple pin plug.
Push back retainers and pull off multiple pin plug.



Unthread nuts (5) - (8).
(1) SR control unit
(2) ME control unit
Pull out control units (1 and 2).



Note:
SR Control Unit (25-pin connector) responsible for:
- injection pump regulation,
- self-diagnosis and
- exhaust gas recirculation.

ME Control Unit (15-pin connector) responsible for:
- starting volume speed/turn
- volume control while driving,
- throttle position
- fuel mass correction
- idle speed control
- need speed control,
- automatic transmission control,
- charge pressure control and
- particulate suppression.



Read out fault memories. SR self-diagnosis.

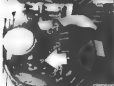
13-71/21

1



13-71-000 REMOVING AND INSTALLING AIR CLEANER

Loosen hose clamp
Pull off hose (1)



Unscrew nut



Take out air cleaner



Installation
Guide in intake neck
Mount housing on rubber mounts



13-72-001 REPLACING AIR FILTER CARTRIDGE

Loosen hose clamps
Open fasteners and pull up filter



Insert filter cartridge
Guide in intake neck
Mount cover and tighten fasteners



Mount hose (1)

13 Fuel system

525td (M51), 525tds (M51)

Notes

13 00 050	Engine die speed – check	13- 00/31
	Layout of electronically controlled injection pump for DOE	13- 00/32
13 31 028	Fuel supply pressure – check	13- 31/31
13 32 000	Fuel filter DOE	13- 32/31
050	Water tap in fuel filter – drain	13- 32/31
051	Friar element – replace	13- 32/32
061	Fuel filter, complete, (with water level sensor and fuel heater) – remove and install or replace	13- 32/32
13 51 000	Injection pump – remove and install	13- 51/31
005	Fuel pump – adjust statically	13- 51/34
	Fuel temperature sensor – replace	13- 51/36
300	Electric fuel cutout – check	13- 51/37
301	Electric fuel cutout – replace	13- 51/38
320	Fuel system bleed	13- 51/39
13 62 520	Pedal position sensor – remove and install or replace	13- 62/31
600	RPM sensor (pulse generator) (M51) – replace	13- 62/31
13 71 000	Air cleaner (M51) – remove and install	13- 71/31
13 72 001	Air cleaner cartridge – replace ..	13- 72/31

For further information on troubleshooting and jobs in assembly 13 refer to Electrical Troubleshooting Manual 5 Series E34

INFORMATION REGARDING CLEAN/MESS WHEN WORKING ON FUEL SYSTEM

- Clean area around point of repair thoroughly, for example before disconnecting pipes/hoses, fittings, etc.

Place removed components only on clean surfaces and cover them with plastic sheet - never use dirty cloths!

Cover or insert plugs in opened pipes/hoses or components immediately - do not work with compressed air

- Install only cleaned components
Take new replacement parts out of packaging only shortly before installation

Keep diesel fuel off of coolant hoses - if necessary wash off immediately with water

EXPLANATION OF ABBREVIATIONS

DDE	Digital Motor Electronics
AE	ERS injection begin control
MLG	Fuel rate, combustion air - road speed
BB	Injection begin relation
ME	Injection rate relation



13-00-000 CHECKING ENGINE IDLING SPEED

Requirements:

- Engine at operating temperature (oil temperature = 40 °C)
- Valve clearance OK
- All electric consumers switched off

Read idling speed* from tachometer in instrument cluster
OR Read engine speed via the diagnosing system

The engine speed can also be read via the diagnostic socket

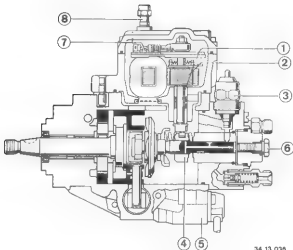
Connect BMW Service Tester

Select engine test step no. 3 (enter number of cylinders)

In case of deviation from specified value
Interrogate fault memory of ODE (refer to ODE Test Plan)

If necessary: check basic setting of pedal valve sender (refer to ODE Test Plan)

**ELECTRONICALLY REGULATED INJECTION
PUMP FOR DOE**



- 1 = Control valve motion sender
Potentiometer for feedback voltage
- 2 = Interlock for injection rate solenoid
- 3 = Electric fuel shut-off
- 4 = Control valve
- 5 = Injection begin solenoid
- 6 = Plug for high pressure chamber
(for static adjustment with dial gage)
- 7 = Fuel temperature sensor
- 8 = Hollow union bolt or pressure valve



13-31/31

13-31/31 CHECKING FUEL PUMP PRESSURE

Squeeze retainer (or pull out completely).
Remove fuel pipe (3) behind the filter.

Caution!
Catch escaping fuel in a suitable container.



13-31/31

Install Special Tool 15 1 300 (adaptor) between pipe (2) and filter housing.



13-31/31

Screw 10 bar pressure connection of BMW Service Tester to Special Tool 15 1 300.
Select Multimeter Setup 10 (refer to operating instructions of BMW Service Tester).



13-31/31

Remove relay box cover.
Remove fuel pump relay (2).



13-31/31



13-31/31

Switch ignition on.
Bridge terminals 30 and 87 on the relay
center with Special Tool 61 3 050.
Operate special tool and read from pump
pressure* from tester.

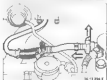
Reinstall fuel pump relay (2).
Run engine at idling speed and read pressure* from tester.



13-31/31

Increase engine speed to 4800 rpm and
observe pressure* on the tester.

The suction effect of the injection pump
should cause the fuel pressure to drop
considerably at high engine speed.



13-31/31

Caution!
Catch escaping fuel in a suitable container
while removing Special Tool 15 1 300.

Installation:
Reconnect pipe only with seals which are
in perfect condition and coat the seals with
an adhesion grease.
Ensure that the retainer engages correctly.

* Refer to Specifications



13-32-080 FUEL FILTER FOR DDE

Note

Fuel preheating is described in Group 12. The water level display is registered via the DDE control unit. Refer to BMW Diagnosing System for information about troubleshooting.

The heating element and water level probe are integrated in the upper section of the filter and may only be replaced together with the complete fuel filter.

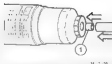


Fig. 1-080

13-32-080 DRAINING WATER TRAP IN FUEL FILTER

Connect suitable hose to drain nipple (1), fit run off, and insert other end into suitable container.

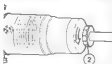


Fig. 1-070

Open drain plug (2) by turning it and drain fuel until pure diesel fuel runs out.



Fig. 1-070

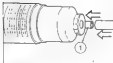
To charge and discharge, press resistor and pull pipe (2) off.

Important:
Catch escaping fuel.

Insulation:
Check seals, replacing if necessary.
Cool seats with acid-free grease.

13-32 001 REPLACING FILTER ELEMENT

Connect suitable hose to drain nipple (1), blow dirt, and insert other end into suitable container.



Open drain plug (2) by turning it and drain fuel.



To charge and discharge, press retainer (1) (if necessary pull out completely) and pump pipe (3) off.

Important:
Catch escaping fuel.

Instruction:
Check seals, replacing if necessary.
Coat seals with acid-free grease.



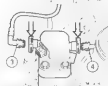
Twist and unscrew fuel filter element.

Instruction:
Note instructions printed on the filter element.



13-32 001 REMOVING AND INSTALLING OR REPLACING COMPLETE FUEL FILTER (WITH WATER LEVEL PROBE AND FUEL HEATER)

Disconnect plug (1) for water level probe and plug (2) for fuel heater.



Press retainers (1) (if necessary pull out completely) and pull pipe (3) and (4) off.

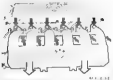
Important:
Catch escaping fuel.

Instruction:
Check seals, replacing if necessary.
Coat seals with acid-free grease.



Loosen bolts (5 and 6) and remove filter.

Empty fuel from filter into a suitable container.



13-51 000 REMOVING AND INSTALLING INJECTION PUMP

Disconnect battery ground lead

Important!
De-energize fuel memories of all systems first as disconnecting the battery will erase them.

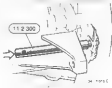
Remove engine splash guards, fan and fan cover
Remove intake manifold - refer to Gr. 1/1

Installation
Replace gaskets
Replace leak oil hoses after removal.



Loosen and remove couplings from injection pump using Special Tool 13-5-020.
Plug openings of injection pump with caps.

Installation
Tightening torque



Hold engine in TDC of cylinder no. 1 (power stroke) using Special Tool 11-2-360



Pull off leak oil hose (1).
Disconnect return pipe (2).
Coupling (3) is matched with injection pump.
Disconnect fuel pipe (4).

Installation
Replace leak oil hose after removal



Checking

Unscrew oil filler cap.
The test cam of the camshaft must test up



Loosen and remove injection pipes from injection nozzles using Special Tool 13-5-020

Important!
Position test in good time to avoid bending the pipes.
Plug openings of nozzles with caps.

Installation
Tightening torque



Unscrew lock head ball fastener bolt

Installation
Check for O-ring

Refer to Specifications

Refer to Specifications



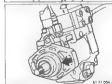
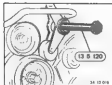
Unscrew central nut.

Screw Special Tool 13 S 120 in, without
pressing-out bolt.

Disconnect plugs.

Unscrew pump mounting bolts.

Attention
Pay attention to washers.



Press pump out by rotating pressing-out
bolt from Special Tool 13 S 120.

Remove pump

Note
Turn pump clockwise so that console can
pass the engine mount console.

Installation
Replace O-ring on pump flange

Important!
Leave special tool screwed until until
pump is reinstalled so otherwise the
springs would fall down and the engine
would have to be disassembled.
Unscrew pressing-out bolt of special tool
completely before installing the injection
pump.



34 13 016

Installation

When replacing pump, transfer the attachments and mounting parts.



34 13 016

Bring injection pump shaft into installed position using Special Tool 13 5 062. The cranking lever must be positioned vertically in front of the notches cam.



34 13 016

Make sure that the woodruff key does not fall out while installing the injection pump.

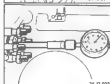


34 13 016

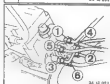
Tighten nuts (1) and (2) before unscrewing Special Tool 13 5 120.



34 13 016



34 13 016



34 13 016

Remove Special Tool 13 5 120. Screw control nut in and tighten.

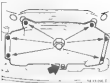
Tightening torque*

Adjust injection pump statically - refer to 13 51 005.

When connecting injection pipes, begin with connection no. 4. Note that pipes for cylinders 1, 5, 3, 6, 2 and 4 are equal to the firing order.

Starting time is longer after assembling diesel fuel system - refer to 13 51 005. Check idling speed - refer to 13 50 000.

* Refer to Specifications.



13-51-008 ADJUSTED INJECTION PUMP STATICALLY

SDS 3

Coolant temperature > 20° C.

Disconnect battery ground lead
Important!

This will erase the fault memories of all systems, so that they must first be interrogated.

Remove engine guard and fan cover

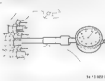
Unscrew plug (1)

In case of loss
Replace seal if necessary
tightening torque

Screw in Special Tool 13-5-330
Secure dial gauge + pressure

Turn crankshaft clockwise in direction of
TDC in cylinder no. 1 (angle about 60°-90°
in advance) until the needle remains at the
deepest point for a short time.
Set scale of dial gauge to zero

Refer to Specifications



Checking TDC in cylinder no. 1 (power
stroke).
Unscrew the meter cap.
First cam of camshaft must point upwards.

Pull out plug (1)
Turn crankshaft clockwise until Special
Tool 13-5-330 can be inserted into appropriate bore of flywheel

Important!
Don't turn in opposite direction of engine
rotation - wrong seal results

Press screw of distributor plunger from dial
gauge
Refer to adjustment + plug

Refer to Specifications



Adjusting
Loosen bolt (1)



Loosen nuts (2 and 3), but do not loosen excessively in order to avoid tension from the chains.



Turn injection pump until dial gage shows the correct value*
Tighten nuts and bolts in sequence of 1 through 3
Tightening torque*
Recheck the adjustment

* Refer to Specifications



SA 13-51-1



SA 13-51-2



SA 13-51-3



SA 13-51-4

13-51 REPLACING FUEL TEMPERATURE SENSOR

Important!
Ensure absolute cleanliness when working on the injection pump.

Remove intake manifold - refer to Gr 13

Installation
Replace gaskets.
Replace leak off hoses after removal.

Disconnect leak off hose (1).
Disconnect return pipe (2).
Rotate union bolt (3) to disconnect with the injection pump.
Disconnect fuel pipe (4).

Installation
Replace leak off hose after removal.

Loosen bolts (1 - 4).
Remove injection rate control unit cover.

Important!
Catch escaping fuel.

Installation
Tightening torque = 7 - 10 Nm



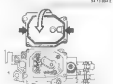
SA 13-51-5



SA 13-51-6



SA 13-51-7



SA 13-51-8

Cover injection rate control unit with clean plastic sheet.

Important!
Potentiometer and slider of motion sensor must not be touched or cleaned.
Foreign particles must be kept out of the injection rate control unit.
They would lead to serious malfunction.

Loosen screws (5 and 6) on temperature sensor and remove screws

Installation
Tightening torque = 0.5 - 0.7 Nm

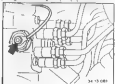
Pull out temperature sensor using a pointed piece spotted on the open/closed flag (not on connecting wheel) and remove.
Don't touch the slider and potentiometer surfaces.

Installation
Check for correct seating and good condition of gasket when mounting the injection rate control unit cover.



13 51 300 CHECKING ELECTRIC FUEL SHUT-OFF

The shut-off receives voltage via the control unit as from ignition key position "2" on. Switching-on will be heard by a loud click.



If a click is not heard, check power supply to the control unit. Other tests – refer to BMW Diagnostic System.



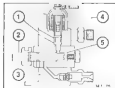
If necessary, check master relay after loosening screws (1 – 4) and removing .



1 = Master relay (white)
2 = Fuel (pump) relay (orange)

13 51 501 REPLACING ELECTRIC FUEL SHUT-OFF

The diesel engine is stopped by interrupting the supply of fuel.
Check fuel shut-off - refer to 13 51 300



- 1 = Feed hose
- 2 = Distributor plunger
- 3 = Distributor head
- 4 = Seal ring
- 5 = H₂ pressure chamber



Disconnect lead on fuel shut-off



Unscrew fuel shut-off using a 34 mm fork wrench.

Caution
Plunger and spring could fall out!



Without current the plunger will be run out by spring force and the fuel head bore shut.

Check O-ring for correct seating.
Tightening torque = 25 ± 5 Nm



14 1 300 E

13 51 300 BLEEDING FUEL SYSTEM

It is not necessary to bleed the fuel system, since the transfer pump builds up pressure in the supply pipe with the ignition key turned to "2".

If the fuel system is drained completely or had been drained for a long time: Press retainer (pull out completely if necessary) and disconnect fuel pipe (2) below the filter.

Important!

Catch fuel in a suitable container.

Install Special Tool 13 5 300 (adapter) between pipe (2) and filter housing. Connect one fuel hose to the threaded nipple and attach other end of hose to a suitable container.

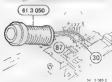


16 1 270 E



16 1 040 E

Lift relay box cover off and remove fuel pump relay (2).



16 1 040 E

Turn ignition on. Bridge terminals 30 and 87 on relay carrier with Special Tool 13 5 030. Operate tool until fuel runs out of filter.

Important!

Catch fuel in a suitable container.

* Refer to Specifications



16 1 039 E

Insulation:
Reconnect pipe only with seals which are in perfect condition.
Coat seals with acid-free grease.
Check retainer engage correctly.



16 1 041 E

Bleeding Injection Pump:
Loosen plug (1) two turns.
Crank engine with starter until fuel runs out.

Important!

Catch fuel in a suitable container.

Injection plug:

Tightening torque = 20 ± 5 Nm.



16 1 033 E

Bleeding Injection Pipes:
Unscrew screws (1, 4).
Remove engine cover.



16 1 044 E

Loosen all coupling nuts on injection hoses using Special Tool 13 5 020.
Crank engine with starter until fuel runs out in pipes.
Retighten coupling nuts.
Tightening torque = 20 ± 5 Nm.
Remove fuel from cylinder head with rags.

13-62 520 Removing and installing replacing pedal position sensor

refer to 13-72 (520)

13-62 600 Replacing RPM sensor (pulse generator) (MS I)

Switch off ignition



Press cover to base to one side so that mark
(1) can be seen on timing case cover
Mark (1) on timing case cover must be aligned
flush with mark (2) on vibration damper



Viewed from above
Mark (1) on timing case cover must be aligned
flush with mark (2) on vibration damper



Location of RPM sensor

Disconnect plug-and-socket connection
Remove RPM sensor together with support



Installation note:

Fit special tool 13-8-040 to support bracket. Mount support bracket with special tool on engine block and push SR II device up against the flywheel. This sets the minimum distance of the RPM sensor to the pin in the flywheel.

Firmly tighten support bracket.



Installation step:

Principle:

Special tool 13-8-040 rests on pin (1) of flywheel.
Unscrew special tool (13-8-040) at support bracket and remove.

Caution!

The support bracket on the engine block must no longer be loosened, only release and remove the special tool.

Fit RPM sensor in support bracket.

Secure RPM sensor.

Reconnect plug-and-socket connection.

Check function, refer to G&S.

Read out defect code memory of GDE control unit, check stored fault messages, repair faults, delete defect code memory.

13 Ft 000 Removing and installing air cleaner (R51)

Remove constant expansion tank



Release screws. Remove upper section of air cleaner.



Remove air cleaner cartridge.



Unscrew air cleaner housing and lift off together with intake duct.

Installation note

Check O-ring for crankcase ventilation, replace if necessary.
Fit screws with screw seating compound, tightening torque 8 Nm.

13 72 001 REPLACING AIR CLEANER FILTER ELEMENT

Unscrew screws (1 - 4).



Pull housing cover up and tilt it out.



Put filter element out.



engage
First engage cover clips at bottom.



13 Fuel system

530i (M60), 540i (M60)

13 00 002	Functional check of digital motor electronics (DME)	13- 00/41
	Component testing	13- 00/41
13 31 029	Delivery pressure of fuel pump – check	13- 31/41
	Overview of fuel filters and lines	13- 32/41
13 32 051	Fuel filter – replace	13- 32/41
13 41 500	Idle speed control valve – replace	13- 41/41
13 51 199	Fuel pressure regulator – check	13- 51/41
530	Fuel pressure regulator – replace	13- 51/42
13 54 030	Throttle assembly – remove and install/seal	13- 54/41
13 61 000	Control unit (for DME) – remove and install or replace	13- 61/41
13 62 511	Intake air temperature sensor – replace	13- 62/41
531	Coolant temperature sensor – remove and install	13- 62/41
560	Air mass meter – remove and install or replace	13- 62/42
13 64 541	Fuel injector valves – all – remove and install or replace	13- 64/41
13 71 000	Air cleaner – remove and install	13- 71/41
13 72 001	Air cleaner cartridge – replace	13- 72/41
13 90 500	Tank ventilation valve – replace	13- 90/41

For further information on troubleshooting and jobs in assembly 13 refer to:
Microfiche Assembly Repair Manual and
Electrical Troubleshooting Manual 5 Series E34



13-00-002: CHECKING FUNCTION OF DIGITAL ENGINE ELECTRONICS (DME)

Connect BMW Service Tester

Carry out brief test

Interrogate fault memories

Interrogate status

Refer to operating instructions of BMW Service Tester/BMW Diagnosing System.

Additional Information on Troubleshooting
 Car Electrical System: Test Plan and Wiring Diagram folders.

Check Mass Air Temperature sensor

Measure resistance of temperature sensor

Check wiring from control unit plug to temperature sensor plug for breaks or shorts!



13-00-003: COMPONENT TEST

Check idling speed control valve

Electric Test

Measure resistance between terminals (1 and 3):

Specification: approx. 13 Ω

Measure resistance between terminals (2 and 1) or (2 and 3):

Specification: approx. 12 Ω each

Dynamic Test

Remove idling speed control valve (plug remains connected).

Open or close rotary plunger (1) fully.

Switch on ignition.

Rotary plunger must move to and remain in a position of approx. 50 % cross section opening.

Refer to BMW Diagnosing System for other tests.



* Refer to Specifications of G1, 12 and 13

** Refer to Wiring Diagrams

Check coolant temperature sensor

Connect Jetronic test lead, Special Tool 81 1 440.

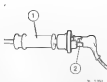
Measure resistance* with ohmmeter. To check resistance in engine temperature range, remove and submerge sensor in a water bath as far as the housing and measure resistance* with ohmmeter.

The temperature sensor measures the engine temperature and sends this information to the control unit as a resistance signal. Resistance drops with rising temperature (NTC).

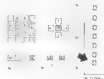
- 1 = Plug connection
- 2 = Housing
- 3 = NTC resistor



81 1 440



81 1 440



81 1 440

Check link vapor venting valve

Connect vacuum hose (1) from BMW Service Tester on 8 mm dia. adapter. Supply 12 V voltage to link vapor venting valve using Special Tool 81 1 440 (2).

Select Multimeter Function Ω on BMW Service Tester.

Set vacuum to 600 - 100 mbar. Switch off vacuum pump.

Vacuum must not drop by more than 50 mbar during the testing time of about 30 seconds. Replace link vapor venting valve if vacuum drops by more than 50 mbar.

* Refer to Specifications of G1 10 and 13.

** Refer to Specifications of G1 10 and 13.

*** Refer to Wiring Diagrams.



13 31 028 Checking delivery pressure of fuel pump

Remove cap (1), release nuts (2).
Remove manifold covering.

If necessary release retaining nuts (3) of constant expansion tank and push tank to one side.



Install BMW SERVICE TESTER¹⁾ or special tool 13 3 080 with connection line and special tool 13 3 084 in fuel supply line upstream of pressure regulator.

Release control.
Remove oil filler cap.



Release nuts (1) and (2) of holder and pull plug connector and cables to one side.

Unplug fuel pump relay (orange).



Connect special tool 13 3 080 to terminal 87 and terminal 30.
Press button and read off "delivery pressure" at pressure gauge.

If the specified delivery pressure is not reached, close off fuel return line after the T piece with special tool 13 3 010. Switch on ignition. Operate special tool 13 3 080.

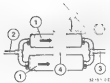
If "delivery pressure" is reached.
Replace pressure regulator.

If "delivery pressure" is not reached.
Check and clean plug and socket connection of fuel pump. Repeat test, if delivery pressure is still not reached. Replace fuel pump.

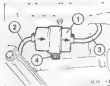


¹⁾ Refer to Technical Data.

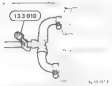
REMOVAL OF FUEL FILTER AND HOSES



- 1 Fuel filter
- 2 Fuel hose from tank
- 3 Fuel hose
- 4 Filter holder



- 1 Fuel filter
- 2 Fuel hose from tank
- 3 Fuel hose
- 4 Filter holder



13 32 051 REPLACING FUEL FILTER
Loosen clamps of hoses on body as much as necessary.
Clamp all fuel hoses using Special Tool (p. 3-945).



Disconnect hoses at fuel filter.
Incapacitate
Catch and dispose escaping fuel



Unscrew nut and remove filter



Installation
Check direction of flow (arrow) or outlet (OUT).

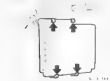


13-41 500 Replacing idle speed control valve

Remove caps (1), release nuts (2).
Remove manifold covering.



Press retaining spring and disconnect plug
connector.



Open clips, lift off upper section of air cleaner.



Release hose clips (3) and (4).
Remove intake hoses together with upper
section of air cleaner.



Press together retaining and detach.
Remove idle speed control valve.



Installation note
First fit sealing ring to throttle flange



Installation note
Ensure seals are fitted on throttle body and
idle speed control valve.



Installation note
Note identification No. (1)*
Check idle speed.

For component testing refer to 13-00



13-51 199 CHECKING FUEL PRESSURE REGULATOR

Press off caps (1)
Unscrew nuts (2)
Remove cover for collector



If applicable, unscrew coolant expansion tank mounting nuts (3) and push tank aside.



Install connector of BMW Service Tester or Special Tool 13-3-050 together with connecting pipe and Special Tool 13-3-054 to fuel feed hose



Unscrew screws
Remove electronic box lid



Unscrew plug rail nuts (1 and 2) and pull plug rail upwards.
Press plug and wiring cable.
Disconnect fuel pump relay (optional)



Bridge terminals 87 and 30 using Special Tools 61-3-050.
Switch on ignition.
Operate special tool.
Read and check system pressure*



System Pressure Drops Too Fast

Disconnect diagnosis socket and clamp return hose behind pressure regulator using Special Tool 13-3-010.
Operate Special Tool 61-3-050 again briefly



If system pressure is now maintained, the pressure regulator is faulty.
If the system pressure drops, there is a leak ahead of the pressure regulator (injection pipes, hose connections, fuel injections, etc.)

* Refer to Specifications of Cr 18



13 51 530 Replacing fuel pressure regulator

Remove and cap (1), release nuts (2).
Remove manifold covering.



If necessary, release retaining nuts (3) from coolant expansion tank and push tank to one side.



Detach diaphragm socket.



Disconnect vacuum hose.



Lift out snap-ring.



Note position of vacuum connection.
Turn pressure regulator and pull out.

Installation note:
Replace seals (1 and 2).



Installation note:
Ensure legs of snap-ring engage in recesses.



13-54 000 REMOVING AND INSTALLING SEALING THROTTLE VALVE ASSEMBLY

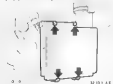
Press off caps (1).
Unscrew nuts (2).
Remove cover for collector



Twist and pull off mass air flow sensor plug



Pull plug (1) off of idle speed control valve and plug (2) off of throttle valve potentiometer



Unclip and pull up air cleaner upper section



Loosen hose clamps and remove/replace hoses together with air cleaner upper section.
Disconnect throttle cable (3).
Pull vacuum hose (4) off of throttle valve assembly



Unscrew screws (1) and (2) and pull off throttle valve assembly



Unclip gasket.
Replace gasket



Unclip gasket.
Attach holders (1) and (2)



Models with Anti Slip Control (ASC):

Pull off plug (1):



Loosen hose clamp and pull off bellows.



Loosen screws (2 - 3).

Take off and place throttle valve assembly



Installation:

Replace gasket (4):



13 61 005 REMOVING AND INSTALLING OR REPLACING CONTROL UNIT (FOR DME)

Unfasten electronic box lid screws.
Remove lid.

Pull up resistor (1) and pull off plug (2).
Unclip resistors (3) and remove control unit.

- 1 = DME control unit
- 2 = ECU control unit
- 3 = ABS-ASC control unit



Installation:
Check code (11) and production date (27)

Relays in Control Unit Electronic Box

- 1 = Fuel pump relay (orange)
- 2 = DME master relay (white)



13-12-14-1



13-12-14-2



13-12-14-3

13-62-51 REPLACING INTAKE AIR TEMPERATURE SENSOR

(After checking function of digital engine electronics (DME) as in 13-00-002.)

- Press off caps (1).
- Unscrew nuts (2).
- Remove cover for collector.

Press in retainer.
Pull off plug.

Unscrew temperature sensor.

Installation.
Tightening torque*

Component Test.

Refer to 13-00-...

* Refer to Specifications.



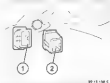
13-12-14-4



13-12-14-5



13-12-14-6



13-12-14-7

13-62-51 REMOVING AND INSTALLING COOLANT TEMPERATURE SENSORS

(After checking function of digital engine electronics (DME) as in 13-00-002.)

Detach and place diagnosis socket aside.

Press in retainer.
Pull off plug (white).

Unscrew temperature sensor.

Installation.
Tightening torque*

Arrangement:

- 1 Temperature sensor for DME (white).
- 2 Temperature sensor for temperature gauge (black).

Component Test.

Refer to 13-00-...

* Refer to Specifications.



13-62-000 REMOVING AND INSTALLING OR REPLACING MASS AIR FLOW SENSOR

(After checking function of digital engine
electronics (DEE) as in 13-00-002.)

Twist and pull off mass air flow sensor
plug.



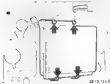
Unscrew screws.
Twist and pull off mass air flow sensor
housing.



Loosen hose clamp and pull off intake
hose.



WARNING
Replace seal.
Coat sealing lip surface on housing with a
small amount of address grease.



Twist and pull off air cleaner upper sec-
tion.



13 64 541 Removing and installing or replacing all fuel injector valves

Remove and cap (1), remove nuts (2).
Remove fuel filter housing.



20 3 29 0

Remove retaining straps for mounting cables.
Detach throttle operating cable at throttle lever.



2 13 140 0

Remove scraper for cylinder head covers on both sides.



20 3 40 0

Disconnect cable connectors from ignition coils on both cylinder heads.



20 3 40 0

Detach throttle operating cable (1) and place in **box**.

Remove cable ducts (2) and place to one side.
Disconnect plug connectors from fuel injector valves.



2 13 140 0

Close off fuel supply and return lines with special tool 13 3 010 and remove.

Caution!
Collect escaping fuel.



20 13 140 0

Release injection tube retaining elements.
Remove injection tube together with fuel injector valves.



20 3 40 0

Press off clips. Remove fuel injector valves from injection tube.

Installation note:
Check seats and replace if necessary. Check fuel injector valves for leaks, refer to 13 64 503.
Before fitting, coat seats of fuel injector valves with acid-free grease.



13-71-14-0

13-71-900 REMOVING AND INSTALLING AIR CLEANER HOUSING

Turn and pull off mass air flow sensor
plug.



13-71-20-0

Loosen hose clamp.
Pull off intake hose.



13-71-30-0

Installation:
Replace seal.
Coat housing at sealing lip surface with a
small amount of engine grease.



13-71-40-0

Installation:
Guide intake neck into opening
Mount housing on rubber mounts.

Unscrew screws (1 and 2).
Turn and pull out air cleaner housing.

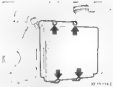


13-71-14-0

Unscrew screws.
Turn and pull off mass air flow sensor
housing.



13-71-100-0



13.73 001 REPLACING AIR FILTER ELEMENT

Unclip.



Lift air cleaner upper section and pull out air filter element.



13 90 000 REPLACING TANK VAPOR VENTING VALVE

(After checking function of digital engine electronics (DME) see 13 90 000)

Tank vapor venting valve and carbon canister are located between bumper lower section and left front wheel house

Push link vapor venting valve out of rubber holder
Press in retainer and put on plug



Disconnected fuel hoses.

Caution!
Cinch recapping fuel

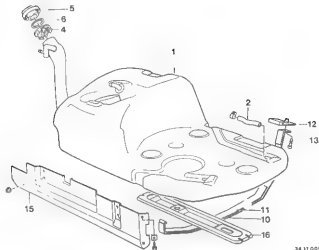
Component Test

Refer to 13 90

16 Fuel supply system

16-11	Overview fuel tank	16-11/1
030	Fuel tank — remove and install	16-11/2
	Overview expansion tank with hose layout	16-11/4
120	Expansion tank for tank venting — remove and install or replace	16-11/5
	Overview tank ventilation on catalytic converter vehicles	16-11/6
16-12 000	Fuel level sending unit and in-tank pump M30 — remove and disassemble	16-12/1
	Connector assignments in-tank pump fuel level sending unit	16-12/4

FUEL TANK SURVEY



- 1 Fuel tank
- 2 Hose
- 4 Filter pipe insert
- 8 Tank cap
- 6 Seal
- 10 Retaining strap
- 11 Liner
- 12 Welded nut
- 13 Mounting screw
- 15 Heat shield
- 16 Adapter



16-11-030 Removing and installing fuel

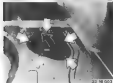
If necessary, partially drain fuel with suction pump**.

Caution!
Observe safety requirements and prevailing national legislation.

Installation instruction:
Only use new hose clips.
Check fuel hoses for condition and any leaks.
Replace if necessary.
Also see Service Information, Dr 16.

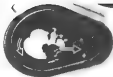
Removing fuel filter panel

Unscrew bolts
Remove cover



Unscrew bolts
Remove fuel hoses

Key:
1 = inlet
2 = outlet



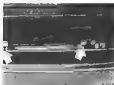
Move slide to one side
Lift out plug.



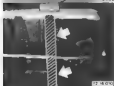
Lift out rubber gasket

If necessary, remove wheel, see 36-16-000.
Unscrew screws.
Lift out filter panel.

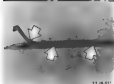
Unscrew bolts
Remove vent hoses.



If necessary, support fuel tank from underneath.
Uncover fuel should come.
Left out fuel tank.



Installation
Replace plastic sheet, if necessary



Installation
Replace battery, if necessary



Installation
Check for correct seating of retaining straps.

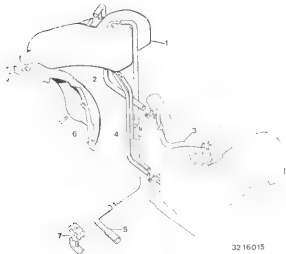


Installation
Check lines (1), if installed, and edge guard (2) replacing if necessary



Installation
Check straps, replacing if necessary

EXPANSION TANK AND HOSE ROUTING SURVEY



- 1 Expansion tank
- 2 Vent hose (filler neck/expansion tank)
- 3 Vent hose (filler neck/fuel tank)
- 4 Vent pipe (fuel tank/expansion tank)
- 5 Spill pipe (expansion tank/floor to atmosphere)*
- 6 Trim panel
- 7 Fuel pipe holder on floor plate

* To carbon canister in cat. conv. cars



16-11-120 REMOVING AND INSTALLING
OR REPLACING EXPANSION
TANK FOR FUEL TANK VENT

Remove rear wheel - see 38-16-000.
Unscrew screws.
Lift out trim panel.

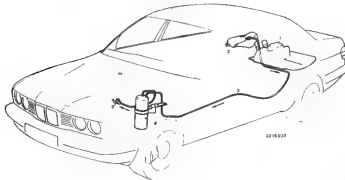


Unscrew screws.
Pull off vent hoses (see hose routing point
no. 60).
Unscrew screw (10).



Unscrew screws.
Pull off vent hoses.
Pull off tank.

16-11 TANK VENTING SURVEY
(see "Form")



- 1 = Fuel tank
- 2 = Expansion tank
- 3 = Pipe
- 4 = Carbon canister
- 5 = Tank venting valve

Note

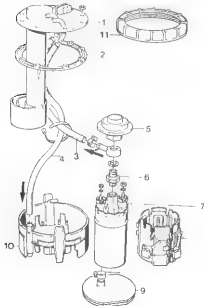
Check tank venting valve - see
12 16 100

Item 4 not used on M 21 engine and
with provisions for catalytic converter.
Vapors are discharged outdoors via
the expansion tank.

16-12/1

16 12 000 Removing and disassembling immersed tube indicator and intake pump

Summary of immersed tube indicator and intake pump



- 1 = Immersed tube indicator
- 2 = Gasket
- 3 = Inlet lead
- 4 = Return lead
- 5 = Pressure damper
- 6 = Non-return valve
- 7 = Fuel pump
- 8 = Pump carrier with damper rubber
- 9 = Fuel screen
- 10 = Pump bracket
- 11 = Union nut

Check fuel pressure and delivery rate.
see Gr 13.

Check immersion tube indicator¹⁾, also refer
to plug allocation on Page 16-124.

¹⁾ Refer to Specifications



If necessary, partially remove fuel with suction pump**)



1) Lift fuel luggage compartment trim panels.
2) Unscrew bolts.
3) Remove lid.



4) Move slide to one side.
5) Pull off plugs.



Plug situation on intake pump and immersion tube indicator
1 = 21 = ground, immersion tube indicator
2 = Tank = warning lamp
3 = Tank = sensor
4 = 21 = ground, fuel pump
5 = EKP 1 = fuel pump 1

***) Sounding Reference NWS



1) Unscrew hose clips.
2) Disconnect fuel hoses.

3) Only use new hose clips.
4) Check fuel hoses for condition and any leaks.
5) Replace if necessary.
6) Also see Service Information, Gr. 15

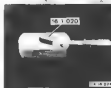


7) Remove inlet lead (1).
8) return lead (2).



9) Unscrew screw nut with special tool No. 16 1 020.

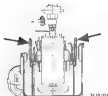
10) Replace sealing ring and screw nut.



Special tool No. 16 1 020



16-5
Unscrew nuts.



Installation
Check for correct fit of retaining hooks

16-6
Fit fuel level sender

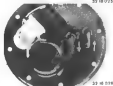


Installation
Replace seal



20-18-014

Unscrew screws
Pull off hoses and electric leads.



20-18-015

Installation
Feed and return hoses are marked

Drain gasoline or wear acid-proof
gloves
Compress retaining hooks and put fuel pump upward.



20-18-016

Installation
Secure electric leads on a fuel hose
with a strap at about the middle



20-18-017

20-18-017



29 16 0 09

Unscrew screws.
Remove pressure damper (1) and check
valve (2).



29 16 0 09

Pull off pump holder



29 16 0 09

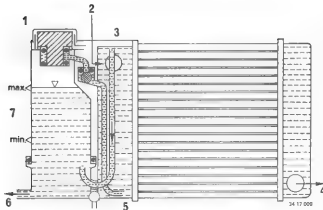
Unscrew screw.
Lift out fuel filter screen

17 Cooling

	Partial flow cooling circuit M20 / M40 / M50	17-	00/1
	Coolant circuit M20 (with independent heating)	17-	00/2
	Coolant circuit 6-cylinder M30 / M21, M5	17-	00/3
	Coolant circuit M50 / M51	17-	00/4
17 00 005	Coolant – drain and fill	17-	00/4a
	■ Cooling system – check for leaks	17-	00/5
010	Check for leaks between cooling system and combustion chamber	17-	00/5
039	Cooling system – bleed and check for leaks	17-	00/6
17 11 000	Radiator – remove and install	17-	11/1
100	Coolant expansion tank – remove and install	17-	11/3
100	Expansion tank M20 / M40 / M50 – remove and install	17-	11/4
100	Coolant expansion tank – remove and install	17-	11/5
509	Radiator – flush	17-	11/6
000	Radiator M51 – remove and install	17-	11/31
150	Oil cooler (for engine oil) – remove and install or replace	17-	11/33
	M51 with intercooler	17-	11/33
	M51 without intercooler	17-	11/33
17 21 000	Oil cooler (automatic transmission) – remove and install or replace	17-	21/1
17 30 000	Radiator shutters – remove and install or replace	17-	30/31
17 32 000	Vacuum box for radiator shutters – replace	17-	32/31
17 40 000	Auxiliary fan, complete – remove and install	17-	40/1
000	Auxiliary fan (M51) complete – remove and install	17-	40/31
17 51 000	Intercooler – remove and install or replace	17-	51/31

Abstract

- 1 Cap with pressure and vacuum valves
- 2 Front engine
- 3 Vent pipe
- 4 To thermostat
- 5 Control pipe
- 6 To water pump
- 7 Lower mark



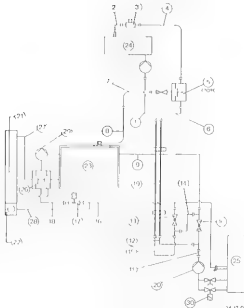
The bypass principle is applied in order to have good air expansion in the cooling circuit. Use of a cross-flow isolator permits integration of the bypass expansion tank on the side of the isolator. The tank is designed two-phase in order to have sufficient tank volume. This version permits a 60 l (transposed) state in the case of heat shock.

The rear pipe floats below the minimum level mark. In this manner it is excluded from the bypass tank to prevent from flowing back into the full flow circuit when uncoupling the tank cap.

The courtyard, built within the last 100 years, is surrounded by a garden with a fountain and a small pond.

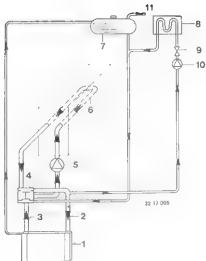
The cooling system is protected against excessive operating pressure by triggering the radiator head pressure. Pressure protection takes place at approximately the amount of the radiator operating pressure during the after-heating phase. This improves the operating safety of the cooling system and the cooling-cool safety while after-heating.

COOLANT CIRCUIT - M 20 (with Additional Heater)



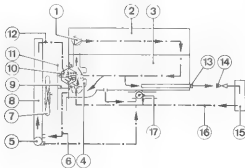
- 1 Molded hose 1
- 2 Molded hose 2
- 3 Bleeder
- 4 Molded hose 3
- 5 Thermostat with check valve
- 6 Molded hose 4
- 7 Coolant hose
- 8 Engine preheating pipe
- 9 Molded hose 7
- 10 Check valve
- 11 Molded hose 8
- 12 Molded hose 5
- 13 Check valve 5
- 14 Coolant hose
- 15 Molded hose 6
- 16 Connecting hose
- 17 Solenoid
- 18 Molded hose 6
- 19 Twin pipe
- 20 Only with air cond. hose!
- 21 Radiator
- 22 Expansion tank
- 23 Engine
- 24 Additional heater
- 25 Heat exchanger
- 26 Thermostat
- 27 Feed
- 28 Return
- 29 Water pump
- 30 Solenoids

COOLANT CIRCUIT FOR 8 CYLINDER M 50 / M 21 / M 5



- 1 Radiator
- 2 Return
- 3 Thermostat
- 4 Water pump
- 5 Engine block/cylinder head flow
- 6 Expansion tank
- 7 Heat exchanger
- 8 Solenoid heater
- 9 Additional water pump
- 10 Split pipe

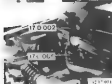
COOLANT CIRCUIT (M450 / M51)



- 1 Water pump
- 2 Crankcase
- 3 Cylinder head
- 4 Thermostat housing
- 5 Expansion tank
- 6 Radiator feed
- 7 Fan with v-belt coupling
- 8 Radiator
- 9 Vent bore
- 10 Thermostat
- 11 Thermostat cover
- 12 Radiator return
- 13 Heater feed
- 14 Heater valve
- 15 Heat exchanger
- 16 Heater return
- 17 Throttle valve heating

17 00 005 Drain off coolant and refill

Refer to Repair Manual, 3 Series E36



17 00 009 Checking cooling system for leaks

On the M 40-M 20-M 50, a check is carried out on the integrated expansion tank on the radiator using test device 17 0 002 in conjunction with adapter 17 0 005.

M 30-M 20-M 50

Fit test device 17 0 002 with adapter 17 0 005 on expansion tank and bring pressure up to 0.1 bar.

Cooling system does not leak if there is not a considerable pressure drop (fall: 0.1 bar) after about 2 minutes.

Check cap.

A. Check pressure relief valve.

Remove cap (1) on special tool 17 0 006 and apply air pressure slowly. Pressure relief valve should open at about 0.5 bar.



Alternative

Check connection for cooling system

Use test device 17 0 002 in conjunction with adapter 17 0 005 and hose section 17 7 810 to check opening pressure* (pressure valve).



Check vacuum valve

Remove adapter onto test device 17 0 006 and slowly develop a vacuum using special tool

Vacuum valve opens at vacuum of approx.

0.1 bar

Check gasket

During raise vacuum valve, check that it is correctly sealed and, if necessary, replace adapter

17 00 010 Checking for leaks between cooling system and combustion chamber

"Tester for cylinder head" **

Fill and perform test.

If there is a leak, the test fluid turns yellow due to the carbon monoxide (combustion gas) entering the combustion chamber (CO).

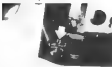
Note

Follow manufacturer's operating instructions.



17 00 038 bleed cooling system and
check for water leaks

Refer to Repair Manual for 3 Series E36



17 11 000 REMOVING AND INSTALLING RADIATOR

Unscrew cap on expansion tank.
Unscrew engine splash guard.
Loosen drain plug and drain, catch and dispose coolant.*

17 11 000

Procedure

Fill and bleed cooling system** - see 17 00 038.
Check cooling system for leaks - see 17 00 008.



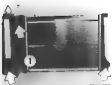
17 11 034

Care with Additional Fan:
Remove right headlight cover



17 11 034

Pull off head on temperature switch (1).



17 11 034

M 20 - M 30

Disconnect coolant hoses.
Tightening torque*.

1 = Drain plug



17 11 034

M 30 - M 31 - M 5

Disconnect split pipe, upper and lower coolant hoses.
Tightening torque*



17 11 034

Care with Automatic Transmission
Unscrew transmission oil cooler pipes and plug with caps.

Installation

Check ATF level, correcting if necessary.

Tightening torque*

Important!
Catch oil.
Replace seals.

* See Specifications
** See Operating Fluids

* See Specifications



Remove separating rivets on left and right sides (pull backwards). Remove fan shroud from retaining tabs and slide backwards over the fan.



Remove top retaining clip from radiator. Press screwdriver downwards and pivot forwards, pulling radiator gently backwards at the same time.



Apply a direction of pressure or pressure point with screwdriver.

1 = Retaining foot

Acceleration.
Press down on top of clip (2), sliding radiator forwards at the same time.

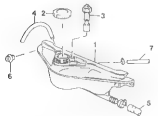


Pull radiator upwards to remove installation.

Place radiator on rubber mounts precisely. Top up cooling system and bleed - 17 00 009.

1 = Rubber mount
2 = Bracket

17 11 100 Removing and Installing Coolant Expansion Tank



32 17 014

Important!

Unscrew expansion tank cap only when engine is cold. Catch coolant and dispose of correctly.

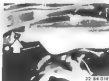
Remove and install check level switch

- 1 Expansion tank
- 2 Buffer cap
- 3 Level switch
- 4 Vent line
- 5 Return line
- 6 Retaining nut
- 7 Inlet line

Fill up cooling system*, bleed and check for leaks.
refer to 17 02 020



Remove plug and overflow tube



Remove inlet and return hoses.
Unscrew nuts on left and right sides of expansion tank and remove container

Remove and install level switch (check with Diagnostic Tester)

Select Check Control with 03.
200 Status LivCheck Control status query coolant level
Electr. troubleshooting refer to Ch. 62.
Tightening torque*

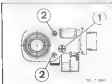
Level switch (manual check)
level switch removed, activate float by hand,
use millimeter to measure throughout.
Float at top => continuity <= 0.5
Float at bottom => no continuity <= 0.5



17-11-160 Removing and installing expansion tank, M 20-M 40/160

Caution*

Unscrew expansion tank cap only when engine is cold. Drain, catch and dispose of coolant.



Loosen bleeder screw (1).
Remove mounting screws (2) and take off upper section.



Pull out expansion tank upwards.

Replace seals.

Fill with specified coolant ** bleed (see 17-00-026).



Container marks indicate fill level at approx. 80°C.

Installation

Top up cooling system* bleed and check for leaks, refer to 17-00-026.

** Refer to Operating Fluids Specification

17-11-100 REMOVING AND INSTALLING COOLANT EXPANSION TANK (M 5)



Caution!
Only unscrew cap when engine is cold.

Drain and dispose coolant!
Remove and check level switch.

- 1 Expansion tank
- 2 Cap
- 3 Level switch
- 4 **Warning**
- 5 Return hose
- 6 Mounting screw
- 7 Feed hose
- 8 Spill hose

Installation
Fill*, bleed and check cooling system
for leaks – see 17-05a



Pull off plug (1) and spill hose (2).



Disconnect feed hose (2), bleeder hose
(4) and return hose (3).
Unscrew screw on expansion tank and
take out tank.



Remove and check (see BMW Diag-
nosing System) level switch.

Manual Test
Remove level switch.
Operate float by hand and measure
power flow with a multimeter.

Specifications
Float up = power flow
Float down = no power flow



17-11 509 Flushing radiator

If oil has penetrated into the coolant circuit, the radiator and expansion tank will have to be flushed and treated with Solvethane[®].

Procedure

1. Remove radiator and expansion tank (refer to 17-11 000-100)
2. Fill with approx. 3 litres of Solvethane
3. Shake radiator and expansion tank thoroughly. Then drain into (Pail 1). (Pail 1) has separated
4. Install cleaned radiator and expansion tank and connect to circuit
5. Fill the entire circuit with hot water. Flush the circuit thoroughly by reversing the water as many times as required to ensure that any remaining cleaning residue are removed
6. Check drained coolant for remaining oil. Repeat, if necessary.
After the cleaning procedure, for the coolant circuit with coolant¹⁾ and bleed the system 17-00 609

Note

Solvethane attacks rubber seals, hoses, etc. and consequently must not be permitted to enter or remain in the cooling system. Always conform with safety measures for the handling of Solvethane (printed on cans).

¹⁾ Refer to Operating Fluids Specification (Gr. 17)

²⁾ Source of Supply: BMW Parts service



17-11-000 Removing and installing radiator hoses

Unscrew cap from expansion tank.
Unscrew and remove splash guard.
Open drain cock and drain off coolant¹⁾. collect and dispose of correctly.

Installation
Fill cooling system²⁾ and bleed, refer to 17-00-036.
Check cooling system for leaks, refer to 17-00-008.



Remove gasket from radiator filter



Remove expanding rivets (1 and 2) by pulling backwards: pull fan shroud upwards and detach.



Remove fan, bearing with special tool 11-5-040 against putty wheel.

Caution!
Left-hand threads: To loosen nut on fan, turn clockwise (i.e. to right).

¹⁾ Refer to Technical Data

²⁾ Refer to Operating Instructions



Precaution

Tighten fan with special tool 11-5-040.
40 Nm tightening torque is equal to 30 Nm on scale of torque wrench.



Remove fan together with fan shroud

Installation
Attach fan shroud correctly



Remove upper coolant hose.
Remove overflow hose (2) and upper coolant hose (3).



Remove lower coolant hose (4) and both inter-cooler hoses (5 and 6).



Models with Automatic Transmission

Unscrew transmission oil cooler lines and seal with sealing plug.

Precaution

Check transmission oil level and top up if necessary. Tightening torque:

Caution

Collect oil as it escapes.
Replace seals.



Remove retaining clip from top of radiator.
Press screwdriver downwards and push forwards, pulling radiator or gently backwards when doing so.



Apply a direction of pressure of pressure point with screwdriver.

1 - Retaining Hook

Precaution

Press down on top of clip (2), pulling radiator forwards while doing so.



Slightly raise radiator and remove intercooler by pulling backwards.
Remove radiator and intercooler by pulling upwards.

Precaution

Position radiator precisely on rubber mounts.
Top up cooling system and bleed - 17 00 008.

Refer to Technical Data



17 11 150 Removing and installing or replacing oil cooler (for engine oil)

M51 with intercooler

Remove front bumper and center radiator grill (BMW railway grille), refer to Dr 50

Unfasten bracket for engine oil lines on engine mount



Disconnect link between oil cooler lines and engine

Caution!
Catch escaping engine oil. Do not allow it to fall on the splash guard!

Installation:
Check and correct engine oil level



Unfasten bracket for engine oil cooler



Unfasten retaining nut



Lift engine oil cooler out of rubber mount and remove

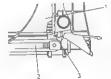
Caution!
Catch oil as it escapes



M51 without intercooler

Unfasten oil lines, hoses

Catch oil installed
Replace gaskets
Tighten engine oil



1 = Radiator
2 = Oil cooler
3 = Retaining clip
Open nut clip 2 and lift out engine oil cooler on left side

17 21 000 Removing and installing or replacing oil cooler (automatic transmission)

For vehicles with integrated transmission oil cooler in the water cooler, refer to 17 11 000. On the M51 engine without intercooler, the transmission oil cooler is identical to the one in the M51 engine with intercooler. Removal refers to 17 11 050.

Vehicles with external transmission oil cooler
Remove complete front bumper refer to 31 11 000.

Remove retaining clip from top of radiator. Press screwdriver downwards and pull up wire, pressing radiator slightly downwards at the same time.

The arrow indicates the direction of pressure and the pressure point of the screwdriver.

1 Retaining hook

Installation:

Press top of bracket (2) down, sliding radiator forwards at the same time.

Push radiator towards engine and unfasten oil cooler screws (1).



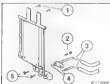
Unfasten screw (1) and remove oil lines (3). Catch oil and dispose of it correctly.

Installation:

Check O-rings (4) and replace if necessary. Measure and top up oil in automatic transmission.



Unfasten screws (5) and lift oil cooler out from





17 30 000 REMOVING AND INSTALLING OR REPLACING RADIATOR SHUTTERS

Pull expansion rivets (1 and 2) out towards rear.
Pull fan cover upwards and disconnect.



Remove fan, while countenholding on pulley with Special Tool 11 5 050.

Important:
Left-hand threads – turn coupling nut on fan clockwise to loosen.

Installation

Tighten fan using Special Tool 11 5 040.
40 Nm (30 lb-ft) tightening torque is equal to 30 Nm on scale of torque wrench.



Fig. 10-1

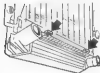


Fig. 10-2

Remove fan together with fan cover.

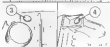
Installation:
Snap fan cover correctly.



Pull vacuum hose (1) off.



Pull expansion rivets (3 and 4) off of radiator shutter.

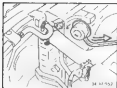


Disconnect radiator shutter by pulling up and remove.



Installation:
First attach radiator shutter at all four sides.

Fig. 10-3



17-32/31 REPLACING VACUUM CONTROL BOX FOR RADIATOR SHUTTERS

Pull vacuum hose off



Press locked retainer off



Pull expansion diaphragm out and remove vacuum control box

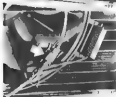


17 40 000 REMOVING AND INSTALLING ADDITIONAL FAN ASSY

Remove front bumper and centre radiator
grill section (BMW highway) - see Gr 5-1
Disconnect cooling belt and unscrew right
hand cone beam.

Note

Remove right headlight grill to improve the
accessibility.



Disconnect plug



Unscrew fan console belts.
Lift out additional fan downwards.

Testing

Check power consumption and speed -
see Specifications of Group 17

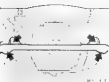


17-40 000 REMOVING AND INSTALLING COMPLETE ADDITIONAL P.A.H.

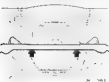
Remove front bumper and middle grille section (BMW safety) refer to Gr 51



Unscrew and remove left and right headlight grille.



Unscrew oil cooler console at left and right



Loosen cable straps



Unscrew engine oil cooler



Unscrew fan console bolts



Disconnect plug

Note:
Unscrew ballast resistor when replacing

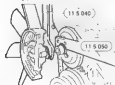


Lift fan console out together with fan



17-51-006 REMOVING AND INSTALLING OR REPLACING CHARGE AIR COOLER

Pull expansion valves (1 and 2) out towards rear.
Pull fan cover upwards and disconnect.



Remove fan, while counterholding on pulley with Special Tool 11-5-040.

Important:

Left hand threads — turn coupling nut in fan clockwise to loosen.

Important:

Tighten fan using Special Tool 11-5-040.
40 Nm tightening torque is equal to 30 Nm on scale of torque wrench.



Remove fan together with fan cover.

Important:

Attach fan cover correctly.



Disconnect engine speed sensor at front.
Disconnect left and right charge air cooler hoses.



Pull vacuum hose off.



Remove clips from top of radiator.
Press, afterwards down and swing it forward while pulling the radiator back slightly.



Arrow = direction of pressure or point of pressure with screwdriver.

1 = Securing hook

Installation:

Press on clip top (2), while pushing the radiator forward.

Pull radiator back at bottom.



See 17-050-2

Unscrew right bolt



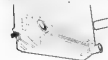
See 17-050-3

Lift radiator as far as possible (with both
ratchet sockets shown)



See 17-050-4

Disconnect charge air cooler on left side
and pull out underneath radiator



See 17-050-5

18 Exhaust system

18 00 020	Complete exhaust system (M30) – remove and install	18-00/1
020	Complete exhaust system (M5) – remove and install	18-00/2
	Layout of exhaust system	18-00/3
	Version with catalytic converter (M51)	18-00/4
	Layout of exhaust system	18-00/5
	Arrangement without catalytic converter (M51)	18-00/5
020	Complete exhaust system (M51) – remove and install	18-00/6
020	Complete exhaust system (M40) – remove and install	18-00/6
18 12 012	Muffler assembly (intermediate and rear muffler) (M30) – replace	18-12/1
041	Front muffler (M30) – replace	18-12/1
	Exhaust system (M51) – disassemble	18-12/2
031	Rear muffler (M51) – replace	18-12/3
040	Front muffler (M51) – replace	18-12/3
031	Rear muffler (M50) – replace	18-12/4
18 32 005	Catalytic converter (M30) – remove and install or replace	18-32/1
005	Catalytic converter (M5) – remove and install or replace	18-32/2



18 00 006 REMOVED AND INSTALLING EXHAUST ASSEMBLY

BMW 520i and 525i

Unscrew both exhaust pipes on exhaust manifold

Preparation

Regulate self locking nuts

Lubricate upper g flange with copper paste CRC**

Fitment springs (2) are factory by tightening nuts (1) with a torque of 18 Nm (13 ft. lbs.) Then loosen nuts (1) again by one and one half turns.

Flanges must be parallel to each other, no

spring must not be preloaded (1)

The pipe with compensator must be regulated last due to the danger of damage.



Adjust the exhaust damper on transmission

Adjust damper without tension

Tightening torque = 22 Nm (16 ft. lbs.)

Disconnect oxygen sensor plug in cars with catalytic converter – see 18 02 805



Cars with Automatic Transmission

Unscrew nut (2)

Preparation

Mount exhaust sensor in throat remove by adjusting nut (1)



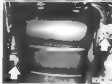
Unscrew holders for suspension on rear axle sensor



Preparation

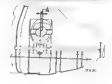
Adjust and lock down holders by moving the tabs on the exhaust pipe after complete installation of the exhaust assembly

Tightening torque = 22 Nm (16 ft. lbs.)



Uncover retainers

Remove entire exhaust assembly



Preparation

Mount retainers in such a manner that rubber rings are preloaded

Preload A = 2 mm (0.078")

Tightening torque = 22 Nm (16 ft. lbs.)



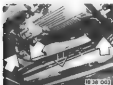
18-00-026 REMOVING AND INSTALLING EXHAUST ASSEMBLY (M 5)

Disconnect plug for oxygen sensor (oxygen retainer)

Unclip electric leads in holder on the transmission



18-38-003



18-38-003

Remove cover
Disconnect electric leads



Unscrew both exhaust pipes on the exhaust manifold

Installation
Tightening torque = 42 Nm (30 ft. lbs.)



18-38-005

Installation
Check gaskets, replacing if necessary

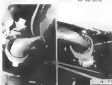
Note
New gaskets hold in place to make installation easier. Pull off plastic sheet. Install gasket with the adhesive surface facing the manifold



18-38-006

Unscrew exhaust support on the transmission

Installation
Mount exhaust support without tension. Loosen bolts on the transmission if necessary



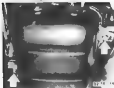
18-38-007

Unscrew holder for exhaust suspension on the rear axle carrier



18-38-008

Installation
Adjust holder after installation of the complete exhaust assembly by moving the tabs on the exhaust and then bolt down with a tightening torque of 22 Nm (16 ft. lbs.)



Unscrew retainers
Remove complete exhaust assembly



Installation
Mount retainers in such a manner that
the rubber rings are preloaded.
Preload distance A = 5 mm (0.197")
Tightening torque = 32 Nm (18 ft. lbs.)

18-00/4

EXHAUST SYSTEM LAYOUT DRAWING (Version With Capacity Converter)

18-00.5

EXHAUST SYSTEM LAYOUT DRAWING (version WITHOUT Catalytic Converter)

18 00 000 REMOVING AND INSTALLING EXHAUST ASSEMBLY - Engine 600 -

Unscrew exhaust pipe from turbocharger



Installation

Align support to be without tension after installation of the entire exhaust assembly



18 00 001

Installation

Check seal, replacing if necessary
Check installed position

Unscrew bracket for suspension from rear axle center



18 00 002

Installation

Lubricate seal and threads with copper paste CRC
Replace seal locking nuts
Tighten nuts until the coil springs are compressed to distance $A = 27 \pm 5$ mm.
Flanges must be parallel to each other and springs must not be compressed flat

Installation

Align (by moving) and tighten the bracket only after installation of the exhaust as assembly has been completed.



18 00 003

Unscrew exhaust pipe from transmission bracket

Detach bracket
Remove exhaust assembly



18 00 004



18 00 005



18 00 006



18 00 007

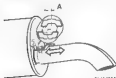


Fig. 18-007-1

Preload

Mount the bracket in such a manner that the rubber ring is preloaded in forward direction by distance A.

A = 10 mm.

Suggestion

Check position of intake in body opening.
If necessary loosen flange connection and rubber suspension rings and align the exhaust assembly.



Fig. 18-007-2

18-00 020 Removing and installing complete exhaust system (R40)

Disconnect rubber ring on rear axle carrier
Unfasten rear suspension
Remove exhaust assembly



Disconnect plug for oxygen sensor
Unsnap wires in holder

Unfasten baffle plate
Unscrew exhaust pipes on manifold

Check gaskets, replace if necessary
Replace self-locking nuts
Coat threads with copper paste CRC*

Unscrew exhaust pipe on transmission holder

Installation
Bolt holder free of tension after finishing installation of complete exhaust assembly

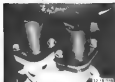
* Source of Supply: BMW Parts service



Installation
Preload rubber mount in direction of travel up to end of long bore



Installation
Check position of tailpipe for body opening.
If necessary, adjust flange connection and rubber suspension rings and align exhaust assembly



18 12 012 REPLACING MUFFLER ASSY (INTERMEDIATE AND FINAL MUFFLERS)

Unscrew muffer assembly on flange
Installation
Check gaskets replacing if necessary
Replace self locking nuts
Tightening torque = 22 Nm (16 ft. lbs.)



Unscrew holders for compensation on rear axle carrier
Installation
Adjust holders on side of exhaust only after installation of the muffer assembly and bolt down
Tightening torque = 22 Nm (16 ft. lbs.)



Unscrew retainers
Remove muffer assembly towards rear



Installation
Mount retainers in such a manner that the rubber rings are pre loaded
Preload Δ = 7 mm (0.276")
Tightening torque = 22 Nm (16 ft. lbs.)



18 12 001 REPLACING PRIMARY

Unscrew exhaust pipe on exhaust manifold and attach it pipe on flange.
Installation
Replace self locking nuts.



Installation
Lockwash tapes on flange with copper paste CRO**
Fasten springs (12) uniformly by tightening nuts (11) with torque of 10 Nm (7 ft. lbs.)
Loosen nuts (11) again afterwards for one and one half turns.
Flange must be parallel to each other or springs must not be precess flat.
Tighten pipe with compensator last due to the danger of loosening.



Unscrew primary muffer on flange
Installation
Replace self locking nuts.
Tightening torque = 22 Nm (16 ft. lbs.)



Unscrew exhaust carrier on transaxle and attach it assembly
Installation
Mount carrier without tension.
Tightening torque = 22 Nm (16 ft. lbs.)



18.12. Disassembling exhaust system (M51)

Release flange connection between front exhaust pipe and catalytic converter or front muffler



Installation note

Check sealing ring and replace if necessary



Installation note

Turn flange such that the largest possible distance to neighbouring components is set
Align flanges parallel



Catalytic converter version

Release flange connection between catalytic converter and rear exhaust system



Note

The sealing cone is formed by the pipe connection.



Installation note

Lightly grease connection with copper paste CRC¹⁾

The flanges must be set parallel with respect to each other
Turn flanges such that the largest possible ground clearance is obtained

After complete installation, align exhaust system and firmly tighten all screw connections to the specified tightening torque²⁾

¹⁾ Refer to Technical Data

²⁾ Source of Supply: BMW Parts Service

18-12/3

18 12 001 Replacing rear muffler (M51)

- Remove complete muffler system.
- Determine parting point (A) on new rear muffler (2).
- Transfer determined size to installed rear muffler and mark.
- Cut exhaust pipe with pipe cutter 00 3 200 and deburr.
- Remove rear muffler.
- Fit weld sleeve (3).
- Align new rear muffler in installation position and connect with weld sleeve (3).

Notes

- Ensure sufficient space to adjacent components.
- Tack weld sleeve (3) with several weld dots.
- Remove muffler system.
- Completely weld sleeve (3) with inert gas welding set.

Installation note

Coat stud bolts with copper paste -CRC-

18 12 040 Replacing front muffler (M51)

- Remove complete muffler system.
- Determine parting point (B) on new rear muffler (1).
- Transfer determined size to installed front muffler and mark.
- Cut exhaust pipe with pipe cutter 00 3 200 and deburr.
- Remove front muffler.
- Fit weld sleeve (3).
- Align new front muffler in installation position and connect with weld sleeve (3).

Note

- Ensure sufficient space to adjacent components.
- Tack weld sleeve (3) with several weld dots.
- Remove muffler system.
- Completely weld sleeve (3) with inert gas welding set.

Installation note

Coat stud bolts with copper paste -CRC-

Location of weld connection

- 1 Front muffler
- 2 Rear muffler
- 3 Weld sleeve

18 12 001 Replacing rear muffler (M50)

Remove center muffler together with rear muffler

Installation note

Coat stud bolts with copper paste (CRC).

Remove rear muffler

Determine parting point on rear rear muffler
Transfer and mark determined size on installed rear muffler.

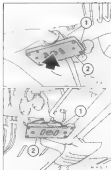
Cut exhaust pipe with pipe cutter and deburr.

Remove rear muffler.

Fit weld sleeve.

Install muffler system in vehicle.

Align new rear muffler in installation position and secure with weld sleeve. Remove muffler and completely weld welded sleeve.



Install muffler

Secure vibration absorber (2) on support bracket of rear muffler with screw.
Tightening torque: 34 Nm.

Feed antenna cable (1) around exhaust support bracket located on rear axle carrier and secure with screw to vibration absorber.
Tightening torque: 24 Nm.

To avoid noises and paintwork damage, ensure sufficient space to adjacent components.

Ensure antenna cable (1) and vibration absorber (2) are fitted into moving and without tension.



Installation note

Model 525a.

A vibration absorber must be installed if the reinforcement plate (1) is not installed at the center muffler on this model. Refer to next page for procedure: Set parting point (2) behind reinforcement plate.

18 12 001 Replacing center muffler (M50)

This job is described in the job instructions "Replacing rear muffler", refer to 18 12 001 (M50).



18.32.006. REMOVING AND INSTALLING OR REPLACING CATALYTIC CONVERTER

BMW 520i and 525i
Disconnect plug for oxygen sensor



Disconnect leads on body or all them out of hood



Unscrew exhaust pipe on exhaust manifold flange
Replace self locking nuts



Installation
Lubricate naps of flange with copper paste **ORG*****

Flatten springs (2) uniformly by tightening nuts (1) with a torque of 10 Nm (7 ft. lbs.)
Loosen nuts (1) afterwards by one and one half turns

Flanges must be parallel with each other or springs must not be pressed flat
Tighten pipe with compressor last



Unscrew exhaust carrier on transmission on perforation
Mount carrier without tension
Tightening torque = 22 Nm (16 ft. lbs.)



Cars with Automatic Transmission
Unscrew nut (2)
Installation
Mount the exhaust carrier without tension by adjusting nut (1)
Tightening torque = 22 Nm (16 ft. lbs.)



Unscrew flange
Insulation
Check gaskets, replacing if necessary
Replace self locking nuts
Tightening torque = 22 Nm (16 ft. lbs.)



Unscrew oxygen sensor (1)
Scrapping information
Used catalytic converters can be returned for scrapping in the same manner as warranty parts***



18-32-005 REMOVING AND INSTALLING OR REPLACING CATALYTIC CONVERTER (M 5)

Disconnect plug for oxygen sensor (bayonet retained).

Unclip electric leads in holder on the transmission.



18-32-002



Remove cover.
Disconnect electric leads.

18-32-003



Unscrew both exhaust pipes on the exhaust manifold.

Installation
Tightening torque = 42 Nm (30 ft. lbs.)



Check gaskets, replacing if necessary.

New gaskets have a self-adhesive coat to make installation easier. Pull off the plastic sheet. Install gasket with the adhesive surface facing the manifold.



18-32-004

Unscrew exhaust support on the transmission.

Installation
Mount exhaust support without tension. Loosen bolt on the transmission if necessary.



Unscrew muffer assembly on flanges.
Take off catalytic converter.

Installation
Check gaskets, replacing if necessary.
Replace self-locking nuts.
Align flanges parallel.
Tightening torque = 22 Nm (16 ft. lbs.)

Important:
Gaskets are different. The wide gasket is located on the connection of the right pipe.



Arrangement of Primary and First Muffer Connection



Uninstall oxygen sensor (1)

Installation

Coat threads with Anti-Seize**

Tighten oxygen sensor with torque of
55 ± 5 Nm (40 ± 3.5 ft. lbs.) with
Special Tool 11 7 020

Note

Never clean an oxygen sensor and
never coat it with a lubricant.
Protect the oxygen sensor while
undercoating a car

Scraping instructions

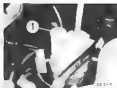
Used catalytic converters may be
returned in the same manner as
warranty parts***

** Source of Supply: MFR

*** See Service Information

21 Clutch

21 00 008	Clutch – bleed	21- 00/1
010	Clutch disk – check for wear	21- 00/2
515	Clutch release travel – check	21- 00/3
21 21 500	Clutch – remove and install or replace	21- 21/1
21 51 500	Clutch release bearing/lever – remove and install or replace	21- 51/1
21 52 500	Clutch master cylinder – remove and install or replace	21- 52/1
510	Clutch slave cylinder – remove and install or replace	21- 52/2
502	Clutch master cylinder – overhaul	21- 52/3
512	Clutch slave cylinder – overhaul	21- 52/3
	Clutch – troubleshoot	21- 90/1



21-01-0

21 00 006 Bleeding clutch

Unscrew filler cap on reservoir
Remove fluid (1)
Connect bleeding device



Slowly open bleeder screw on clutch slave cylinder until air bubbles no longer escape
Depress clutch pedal several times



If air is still trapped in the hydraulic system after bleeding several times, the slave cylinder must be removed from the transmission.
Press push rod as far as it will go in slave cylinder and release slowly.
This forces any residual air still trapped into the reservoir and achieves the maximum clutch release travel.
Do not press clutch pedal with slave cylinder removed.

21 06 518 Checking clutch disk for wear

Transmission

Gearing 240-5, 260-5, 280-5, 280-5

Transmission

85D 2000-2500, 85D 2600-3102

85D 4000-4400

Remove slave cylinder (see remains correct too, refer to 21 02 310

Fit special tool 21 2 060, between transmission casing and slave cylinder or piston rod of slave cylinder

Clutch disk D E

Shoulder of special tool 21 2 060 rests on flange of slave cylinder

Clutch disk worn

Special tool 21 2 060 cannot be pushed in so that the shoulder rests in the slave cylinder A gap (A) of approx. 5 mm remains

Fit special tool 21 2 070 such that the scale for the particular type of transmission can be

Read

Determine type of transmission, refer to Technical Data Transmission Adapter from 193 92

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

Y

Z

AA

AB

AC

AD

AE

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The clutch disk must be replaced if the red area (2) can be seen.

- 1 Clutch disk O.R.
- 2 Clutch disk worn



21 00 515 Determining clutch release travel

Fit test gage 21 2 060 in the recess and firmly press on piston rod of slave cylinder
Depress clutch pedal

Remove slave cylinder from transmission
Line remains connected

Measure marking line (M) made by test gage
If the clutch release stroke (marking line) is less than 20 mm, either there may be air in the hydraulic system or a gasket alarm may be defective

21 21 500 Removing and installing or replacing clutch

(Transmission removed)



Loosen screws clockwise by one turn at a time until the clutch disc spring is released.
Remove clutch and clutch disc.

Installation note

To avoid tension in the cover (can cause judder when starting off), fit screws by hand and then tighten clockwise by one turn at a time.

For tightening angles refer to Technical Data 21 21 142.



Engine M20, M21, M40, M50, M52
Block flywheel with special tool 11 2 170



Engine M30, S38
Block flywheel with special tool 11 2 180



Engine M40
Block flywheel with special tool 11 2 190

Installation note

Engine S38

Remove clamping plates and screws



Installation note

Centre clutch disc with special tool 21 2 100, 120, 130 depending on diameter of transmission input shaft.



Installation note:

- 1 Flywheel dual mass flywheel
- 2 Clutch disk
- 3 Clutch

Caution:

Handle clutch disk carefully. do not touch surfaces of friction pads. install clutch disk (2) in correct position. Observe "engine side" "transmission side" printed on disk.



Check clutch disk for wear and damage and replace if necessary.
Bored clutch disks must always be replaced.
Press together clutch disk at test point (vice screw clamp) and measure thickness (A).

Minimum thickness, refer to Technical Data

Check that deep-groove ball bearing in crankshaft moves smoothly and also check for leaks, replace if necessary.

Check that flywheel retaining screws are oil-tight and replace if necessary.

Clean flywheel and clutch, check for wear and damage.
Replace flywheel/clutch if necessary.

Caution:

Before installing a new flywheel and a new clutch, the anti-corrosion agent on the friction pads must be removed completely.
Dry oil cleaning agents approved by BMW for this purpose.
Refer to BMW Parts Service

21 51 500 Removing and installing or replacing clutch release bearing / lever

(Transmission removed)



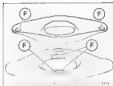
Remove release bearing (2)
Clean all sliding surfaces on release bearing

Installation note
Release bearing with plastic guide must not be greased on sliding surface for guide sleeve otherwise the release bearing can stick on the guide sleeve

Sliding surfaces (3) of the release bearing must rest on the sliding surfaces (2) of the release lever



Pull release lever (4) out of spring clip (5) and replace



Installation note:
Clean release lever and thinly grease on sliding surfaces (3).
Warning:
refer to BMW Fluids and Lubricants Specifications.



Check spring clip (5) and ball stud (6) for damage and replace if necessary

Note
The spring clip and ball stud must always be replaced on transmission 543 4290



Clean guide sleeve (7)

Caution!
Do not grease guide sleeve



21 52 500 Removing and installing or replacing clutch master cylinder

Release line (1) to slave cylinder

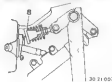


Unscrew filler cap on reservoir
Remove fluid (2)
Drain off brake fluid in reservoir down to connection of top-up line



Remove bottom left trim gump for instrument panel 51 45 180
Remove piston rod (3) from clutch pedal

Installation note:
Adjust clutch pedal with eccentric screw (7) (refer to Group 33)



Caution:
Before installing piston rod (3), engage inner center helper spring (4) in guide lug (6) on pedal assembly



Remove top-up line (4). Release screws (5) and 6). Remove master cylinder

Bleed clutch 21 00 006



12 21 418



10 21 407

21 52 510 Removing and installing or replacing clutch slave cylinder

Use new filter cap on reservoir

Remove float (2). Drain off brake fluid in reservoir down to connection of top-up line.

Detach slave cylinder from transmission

Remove slave cylinder

Release line (3)

Installation note

Thickly grease push rod at contact surface to release lever

Grease

refer to BMW Fluids and Lubricants Specifications

Breeder screw points downward.

Bleed clutch

refer to 21 00 006



21 52 502 Overhauling clutch master cylinder

(Master cylinder removed)

Clean master cylinder and inner parts with spirit.

If cylinder barrel is scored or has corrosion points, replace complete master cylinder. Install repair kit.

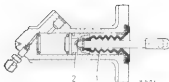
Note:

Only use repair kit of corresponding master cylinder manufacturer.

Consisting of

- 1 Piston assembly
- 2 O-ring
- 3 O-ring
- 4 Sealing plug
- 5 Compression spring

Lightly coat cylinder barrel and grooved ring with brake cylinder paste - ATF**.)



21 52 512 Overhauling clutch slave cylinder

(Slave cylinder removed)

Clean slave cylinder and inner parts with spirit.

If cylinder barrel is scored or has corrosion points, replace complete slave cylinder. Install repair kit.

Note:

Only use repair kit of corresponding slave cylinder manufacturer.

Consisting of

- 1 Protective cap
- 2 Grooved ring cup
- 3 Retaining ring
- 4 Teethed ring

Lightly coat cylinder barrel and grooved ring cup with brake cylinder paste - ATF**.)

**.) Refer to BMW Parts Service

TROUBLESHOOTING CLUTCH

Condition	Cause	Correction
Clutch slips	<ul style="list-style-type: none"> a) Clutch control pressure insufficient b) Clutch liner wear excessive c) Oil on liner - transmission or input shaft seal faulty d) Clutch overheated e) Clutch not original BMW part 	<ul style="list-style-type: none"> a) Replace clutch disc 21 21 b) Replace drive plate 21 21 c) Replace faulty seal and drive plate d) Replace clutch disc 21 21 e) Install original BMW part
Clutch grabs	<ul style="list-style-type: none"> a) Liner not specified type b) Oil on liner c) Release pressure not correctly d) Pressure plate pressure cracked e) Crankshaft not aligned with transmission input shaft f) Engine and transmission suspension defective g) Drive plate not original BMW part 	<ul style="list-style-type: none"> a) Replace drive plate 21 21 b) Replace drive plate 21 21 c) Check release lever d) Replace pressure plate 21 21 e) Check centering surfaces on engine and transmission f) Replace engine and transmission suspension g) Install original BMW part
Clutch will not separate	<ul style="list-style-type: none"> a) Drive plate quenched excessively or liner bridge b) Drive plate lateral support excessive c) Liner riveted on flywheel d) Drive plate secured on transmission input shaft e) Pilot bearing for transmission input shaft in crankshaft faulty f) Air in clutch hydraulic system g) Tangential leaf springs of clutch bent off 	<ul style="list-style-type: none"> a) Replace drive plate 21 21 b) Straighten or replace drive plate 21 21 005 c) Clean flywheel, roughen liner with emery cloth d) Service drive plate on transmission input shaft, replacing damaged parts if necessary e) Replace pilot bearing in crankshaft 11 21 521 f) Bleed clutch 21 00 006 g) Replace clutch disc 21 21
Clutch noise	<ul style="list-style-type: none"> a) Imbalance of clutch disc and drive plate excessive b) Torque damper defective c) Clutch release defective d) Pilot bearing for transmission input shaft in crankshaft faulty e) Rivets of clutch label 	<ul style="list-style-type: none"> a) Replace clutch disc or drive plate 21 21 b) Replace drive plate 21 21 000 c) Replace clutch release 21 51 001 d) Replace pilot bearing in crankshaft 11 21 521 e) Replace clutch 21 21

23 Manual transmission

00 11 229	Oil change in transmission	23-	0/1
23 00 022	Transmission – remove and install	23-	0/2
023	Transmission – remove and install – 4-wheel drive	23-	0/5
032	Exchange transmission – install	23-	0/9
23 12 053	Radial seal for output flange – replace	23-	12/1
083	Radial seal for selector shaft – replace	23-	12/2
	Selector transmission – troubleshoot	23-	90/1

For further work, refer to Construction Group Repair Manual



60 11 229 Oil change in manual transmission

Oil should only be changed at operating temperature.
Unscrew drain plug (1) and filter plug (2).
Drain oil.

Caution*

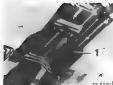
On the M 3 model:
The filter plug (2) on transmission 260 is located in the adapter case.
The opening (4) in the front section of the case is sealed with a sheet of paper and must not be used.

Note

Dispose of used lubricant properly.
Clean and screw in drain plug.
Tightening torque 23.05 44.2*

Fill new oil through filter aperture.
Refer to User or Component Specifications for grade of oil.
Volume*
Oil must overflow through filter aperture.
Screw in filter plug (2).
Tightening torque 23.05 44.2*

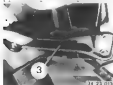
* Refer to Specifications



23-00-017



23-00-018



23-00-019



23-00-020

23-00-022 Removing and installing transmission

Disconnect negative lead from battery
Caution!
 First read 'Fault memories with tester and point any faults as fault memories of control units will be cancelled by disconnecting the battery.
 Remove underbody protection.
 Remove complete exhaust unit 18-00-000 Model 514 16, 165.
 Remove splender assembly, 18-12-012.
 Remove heat baffle plate (1).

Model 515 16a-16 17
 Remove coolant expansion tank (1) from engine firewall.
 Connect hoses remaining connected.
 Remove overflow hose from expansion tank.
 Remove assembly underbody protection.

On vehicles with 4-wheel drive, remove transfer box 27-10-010.

Version with support.
 Remove support (3) on turbine.
 Installation instruction.
 Tightening torque*

Version with bracket.
 Remove bracket (4) from tunnel.
 Installation instruction.
 Tightening torque*

* Refer to Specifications.



Remove cable from reverse gear switch.
 Support transmission from underside.
 Remove crossmember (2).

Installation instruction.
 Center transmission (see Gr. 28).
 Tightening torque*

Version with M 90 engine.
 Remove crossmember (2).

Installation instruction.
 Tightening torque*

Unscrew joint disk on transmission.

Note
 On vehicles with vibration absorber (3) is secured at same time.
 Installation instruction.
 Ball model has thicker flexible coupling, note length of bolts.
 Models 514+ 523 + = 54 mm
 16 5 = 60 mm

Installation instruction.
 Tighten nuts with 19 mm insert (standard size) fitted to torque wrench.
 Tightening torque*

Caution!
 To avoid torsion stress on flexible coupling, only tighten nuts on the flange side.

* Refer to Specifications.



Version with sliding member
Loosen ring nut (1) a few turns

Installation instruction
Tighten ring nut (1) with special tool 28 1 040
after finishing installation.
Tightening torque*



Unscrew center mount.
Installation instruction
Preload center mount in direction of travel (A)
With sliding member on center mount
A = 4 - 5 mm.
Without sliding member on center mount
A = 3 - 4 mm.
Tightening torque
Band flexible coupling downwards and
remove from centering spigot.
Caution!
Don't let the propeller shaft fall into the gears.
Support propeller shaft from car on a piece of wire.



1181 model
Three-section propeller shaft.
Remove second center mount from rear of
body

Installation
Preload center mount in direction of travel
A = 2 - 4 mm.
Tightening torque*



Lift out retaining disk (4) and remove washers
(5).
Refer to Specifications.



Lower transmission.

Caution! Model 1181.
To avoid distortion of the engine flange, be-
fore draining the transmission always insert
spacer plate 12 1 330 between crossmember
and oil pan.
On version with 1181 engine.
To prevent the transmission from contacting
the stabilizer bar, insert spacer plate 25 1 330.



Lift spring (1) off of tab (2) on case using a
screwdriver and spring upwards.
Put out shaft

Installation instruction
Lubricate shaft lightly with Molykote Long
term 2



Remove clutch slave cylinder
Pressure pipe remains connected.

Installation instruction
Also secure bracket (1) for pressure lead, if
needed.
Tightening torque*



Unscrew transmission on engine.
Unscrew Torx bolts with a Torx socket.
Remove transmission forward rear

Caution! Installation instruction.
Washers must be used on the version with
Torx bolts to avoid increasing the breaking
torque.
Tightening torque
1181 model
Also secure bracket for heating connections

* Refer to Specifications

* Refer to Specifications

**Caution!**

Check that **cover sleeves (1 and 2)** are not missing prior to installation of the transmission. Transfer guide sleeves from transmission or replace guide sleeves as applicable.

Coat splines and gears **plus** lightly with Molykote G-L 201** prior to installation of the transmission.

Check oil level.

**Caution!**

On model with M 5 engine

The filter screen (3) on transmission 280 is located in the adapter case.

The aperture (4) in the front section of the case is sealed with a shear-off bolt and must not be used.

23 00 023 Removing and installing transmission - 4-wheel drive -

Uncover negative lead from battery support point and remove.

Caution!

First read fault memories with tester and print any faults as fault memories of control units will be cancelled by disconnecting the battery.
Removing and installing exhaust unit 18 00 029



Uncover propeller shaft on transmission.

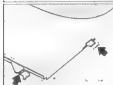
Replace prop nuts

Tightening torque 26 11 3A.2



a Unfasten fan shroud

Remove expanding rivets from fan shroud and lift fan shroud up slightly



Installation instruction

Curve 1 up fan shroud on left and right and in center



Uncover center mount

Installation instruction

Propeller center mount in direction of travel
A x 2 - 4 mm

Tightening torque 26 11 6A.2



Fold propeller shaft downwards and withdraw from transmission

Caution!

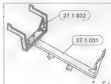
Do not allow the propeller shaft to drop into the joints.

Suspend propeller shaft from car on a piece of wire



b Remove propeller

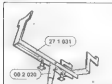
Remove heat deflection plate



Pre-assemble special tools 27 1 031 and

27 1 032 to suit manual selector transmission

* Refer to Specifications



Support transmission on lifting fixture 00 2 030



Screw additional bracket on to secure the transmission



Set inclination by tightening the knurled-head bolts

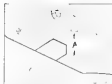


Unscrew cross-member from body and transfer to body and remove

Lower transmission

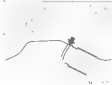
Installation instruction:
Tightening torque 20 N·m (14.2 ft·lb)

* Refer to Specifications



Jam a block (wooden or similar material) between front axle carrier and engine oil pan (it is 50 mm)

The block prevents the engine from tipping too much when the transmission range is under used



Installation instruction:
When lowering the transmission, the coolant air guide for the alternator can slip out. Check once the transmission has been installed



Remove cable from reversing light switch



Turn bayonet connection for transfer box control counter-clockwise and remove

Installation instruction:
Fit plug in such a way that the marking grooves are aligned with each other

Remove bracket for cable on transmission control unit.



6. Removing clutch slave cylinder

Unscrew clutch slave cylinder.
Pressure pipe remains connected.

Caution!
Do not activate the clutch pedal.



7. Remove selector arm

Left side:
Insert screwdriver between spring and transmission case.
Lift spring off leg on case and swing upwards.
Remove bolt.



Right side:
Insert screwdriver between spring and transmission case.
Lift spring off leg on case and swing upwards.
Remove bolt.



Installation instruction:
Check that selector arm is in correct position in rear rubber grommet.



Put off register



Withdraw selector rod.

Note:
Take care of washers.



8. Remove transmission

Disconnect transmission flange from engine





Installation note:
Note washers on Torx screws.

For tightening torque, refer to Technical Data
20 00 142



Installation note:
Clean splines of clutch disk.
Clean splines and guide pins of drive shaft
and grease thoroughly.
The amount of grease necessary for this
purpose corresponds to the size of a barrel of
corn (maize).
Grease:
refer to BMW Fluids and Lubricants Specifica-
tions.

Remove transmission by pulling to rear

Installation note:
After installing the transmission, check oil
level in clutch transmission and transfer box.



Installation note:
Note fitted bushes (1, 2).
If necessary, use fitted bushes from transmis-
sion or replace.
Ensure covering plate is fitted in correct
position.

Installation note:
Remove release bearing and release lever,
clean and grease at specified points.
refer to 21 01 020

23 00 032 Installing exchange transmis-

Removing and installing a exchange transmis-

sion 23 00 002

Transmission identification

Belted code* located on front section of trans-

mission

All

Install release bearing and release lever in the new transmission, refer to 23 51 500



Transmission type 2F-B 5-16-B 5-G 1-10-2

Note

Before installing transmission, fit breather (1) (new adhesive label).
Remove breather (1) and protective sleeve (2) from gearshift shaft.
Remove end-cap (3) and install breather



Caution

New breather as of 8-88

Differentiating features

New version (4)

Old version (5)



Breather version (4)

Ensure the breather is fitted correctly due to the increased height.

Centre breather with plastic-headed hammer and knock in with steel (3) positioned in longitudinal direction of the transmission.

Log collides with casing wall



Convert shift rod joint

Push back retaining sleeve (1).

Drive out parallel dowel pin (2).

Convert exhaust support bracket and backup light switch

Caution

Transmissions are supplied fitted with oil.
Therefore only check the oil level after installing the transmission.



23 12 053 Replacing radial oil seal for output flange

From propeller shaft and center bearing
(Removal), refer to 23 00 032
Left out last washer (*)

Installation note
Replace last washer



Fit special tool 23 1 200
Hold output flange with special tool 23 1 200
Release flanged nut with socket 23 1 210

Installation note
Fit flanged nut with screw locking compound**)
Tightening torque*



Transmission 55 0 310 Z

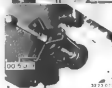
Hold output flange with special tool 23 0 020
Remove flanged nut (*) with socket 23 0 020

Installation note
Fit flanged nut (*) with screw locking compound**)
Tightening torque*



Remove output flange with special tool
23 1 150

Installation note
Transmission 550 315Z
Heat output flange to approx. 80 °C (hot air blower).
Slide output flange onto output shaft and, if necessary, drive on as far as it will go with special tool 23 1 180



Remove radial oil seal with special tool
23 2 010

Transmission 240, 260, 280

Oil sealing lip of radial oil seal
Install radial oil seal flush with special tool
23 1 380 in conjunction with 23 0 020



Transmission 5 3 0 200 G

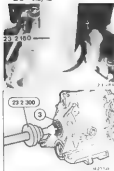
Oil sealing lip of radial oil seal
Install radial oil seal flush with special tool
24 0 110



*) Refer to Technical Data

***) Source of supply: BMW Parts Service

23-12/2



2F-3 5-16 Transmissions

Lubricate seating lip of the radial oil seal with oil.
Drive radial oil seal in flush using Special Tool 23-2-160

3 5 0 3+0 2 Transmissions

Lubricate seating lip of the radial oil seal with oil.
Drive radial oil seal (2) in flush using Special Tool 23-2-300

Important!

Use a plastic hammer to drive seals in.
Check oil level, correcting if necessary



21 17 802 REPLACING RADIAL OIL SEAL FOR SHIFTER SHAFT

Lower the propeller shaft refer to 23-09-802
Engage 5th gear
Push locking sleeve (1) out of the way and drive cylindrical pin (2) out

Lower radial oil seal out using a narrow

Lubricate seating lip of the radial oil seal with oil.
Drive radial oil seal in using Special Tool 23-2-340
Check oil level, correcting if necessary

3 5 0 3+0 2 Transmissions

Drive radial oil seal (1) in using Special Tool 23-2-260

Replacing radial oil seal for input shaft refer to 23-12- in the Construction Group Repair Manual

TROUBLESHOOTING ON MANUAL TRANSMISSION

FAULT	CAUSE	CORRECTIVE MEASURES
Oil on clutch bell housing	a) Guide flange leaking	a) Seal guide flange
	b) Radial oil seal for drive shaft leaking	b) Replace radial oil seal 23 12
	c) Gasket on and cover (crankcase leaking)	c) Replace gasket 11 14 811
	d) Radial oil seal for gearshaft leaking	d) Replace radial oil seal 11 14 811
Oil on output flange	a) Radial oil seal for output flange leaking	a) Replace radial oil seal 23 12 863
	b) Radial oil seal for gearshaft shaft leaking	b) Replace radial oil seal 23 12 863
Transmission leaking between front and rear section	a) Casing leaking	a) Seal casing
Oil on breather	a) Oil level too high	a) Correct oil level
	b) Wrong oil (excessive foaming)	b) Replace oil
Gear does not lock in - jumps out	a) Sliding sleeve worn, slide rail defective, springs broken	a) Replace defective parts 23 23
	b) Sliding sleeves for 1st/2nd gear and 3rd/4th gear interchanged	b) Install sliding sleeve correctly 23 21
	c) Gearshaft arm mounting defective	c) Check gearshaft arm mounting 23 11 311
	d) Shift fork worn	d) Replace shift fork 23 21
	e) Output flange loose	e) Secure output flange

TROUBLESHOOTING MANUAL TRANSMISSION

Condition	Cause	Correction
Hard mowing, frequent shifts (synchronizing)	<p>a) Clutch disengages insufficiently</p> <ol style="list-style-type: none"> Pedal travel insufficient Drive plate worn Lower plate on flywheel Drive plate seated on intermediate input shaft Bearing in crankshaft for transmission input shaft faulty Air in clutch hydraulic system <p>b) Cold shifting force too high</p> <p>c) Excessive play in selector lever bearings</p> <p>d) Selector forks worn</p> <p>e) Sliding sleeve worn</p>	<p>a)</p> <ol style="list-style-type: none"> Check/adjust pedal travel, remove excessively thick mats, free clutch pedal for shifts 26 21 000 Replace drive plate 21 21 000 Clean flywheel, replace drive plate 21 21 000 See 4a or replace drive plate 21 21 000 Replace bearing in crankshaft 11 21 071 Bleed clutch 21 00 000 <p>b) Force on HD engine oil 54L 30 - 40</p> <p>c) Check selector lever bearings, replacing worn rubber inserts if necessary 26 11 211</p> <p>d) Replace selector forks 23 21</p> <p>e) Replace sliding sleeve 23 23</p>
Transmission screeches all in shifting	<p>a) Clutch disengages insufficiently - see all above</p> <p>b) Synchronizing rings worn, sliding sleeve scored</p> <p>c) Reverse gear: shifting break of 2 seconds not held</p>	<p>a) See all above</p> <p>b) Check synchronization/replace damaged parts 23 23</p> <p>c) Keep to specified break</p>
Transmission loud	<p>a) Oil level too low</p> <p>b) Transmission shaft bearings defective</p> <p>c) Damaged parts (gears)</p> <p>d) Needle bearing or output or input shaft faulty</p> <p>e) Bearing in crankshaft for transmission input shaft faulty</p>	<p>a) Correct oil level</p> <p>b) Replace all bearings 23 21</p> <p>c) Replace pair or set of gears 23 21</p> <p>d) Replace needle bearing 23 21</p> <p>e) Replace bearing in crankshaft 11 21 071</p>

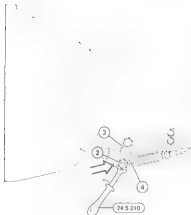
24 Automatic transmission

4 HP-22 / H + EH

24 00 006	Selector lever throttle linkage and throttle cable—adjust	24 00/1
011	Hydraulic pressure values – check	24 00/4
022	Transmission – remove and install	24 00/5
042	Transmission – exchange	24 00/9
24 11 002	Oil sump – remove and install	24 11/1
052	Transmission extension – remove and install/seal	24 11/2
24 12 013	Radial oil seal for output flange – replace	24 12/1
103	Radial oil seal for manual shift valve shaft – replace	24 12/2
24 30 002	Valve body – remove and install	24 30/1
24 31 152	Oil strainer on valve body—remove and install	24 31/1
24 32 002	Centrifugal governor – remove and install	24 32/1
505	Centrifugal governor – disassemble and assemble	24 32/1
24 34 002	Parking lock pawl – remove and install	24 34/1
102	Throttle cable – replace	24 34/1
702	Throttle cable spring – replace	24 34/2
851	Solenoids – replace	24 34/3
	Solenoids (for lockdown downshift lock) – replace	24 34/3
860	Pressure regulator – replace	24 34/4
870	Pulse sender – replace	24 34/4
24 35 500	Wire harness for automatic transmission – replace	24 35/1
502	Wire harness for lockdown downshift lock – replace	24 35/1
24 61 500	Control unit (LH) – remove and install or replace	24 61/1
514	Control unit for downshift lock – replace	24 61/2
	Control unit for lockdown downshift lock – replace	24 61/2
	Automatic transmission – troubleshoot	24 90/1

Refer to "Group 24 in Construction Group Repair Manual" for other jobs

24 00 000 ADJUSTING SELECTOR LEVER, THROTTLE LINKAGE AND THROTTLE CABLE



Move selector lever (1) to "P"
Loosen nut (3).

Important!
Always counterhold pin with Special Tool
24 5 210 to avoid deformation of the cable.
Special Tool 24 5 210 can only be applied
to position P.

Press lever (2) forward (park position)
Press cable rod (4) opposite forward
direction.
Clamp cable rod (4) by tightening nut (3)
(counterhold with Special Tool 24 5 210).
Tightening torque: 10 - 12 Nm.



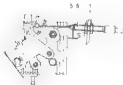
M 20 engine

B) Adjusting Throttle Cable
Requirement: correct full throttle adjustment - adjust if necessary - see 25-61-421

M 20 Engine

Adjust play (8) to 0.50 ± 0.25 mm
(0.020 ± 0.010 ") with nuts (7) in idle position.

M 20 Engine

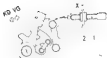


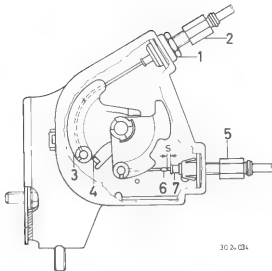
Check Kickdown stop (2).
Loosen lock nut (3) and screw in kickdown stop (2).
Operate accelerator pedal (4) up to the transmission pressure point.
Unscrew the kickdown stop in this position, until the accelerator pedal bears.
Operate accelerator pedal (4) to kickdown (final position).
Now clearance (8) from heel seat (3) to end of sleeve (4) must be at least 44 mm (1.732").

M 20 Engine with Passing Element in Throttle Valve Assembly

Requirements: throttle cable in correct installed position and connected on the throttle valve over
Basic distance (X) = approx. 22.5 mm (0.886")

Move throttle valve to full load position
Turn adjusting screw (1) to adjust the throttle cable without play in full-load position or transmission kickdown pressure point.
Tighten lock nuts (2) in this position
VG = Full load position
KD = Kickdown position





#1 Adjusting Throttle Cable (BAMR 524 cc)

Version with pedal valve system

Requirement: correct engine idle speed

If not: adjust engine idle speed - see 12.72

Counterhold on nut (1)

Turn adjusting screw (2) until reaching lower

(2) (see on step 04)

Cable must not sag after this step

Adjust play (5) between leg (see 04) and

screw (7) to 0.50 ± 0.25 mm (0.020" - 0.010")

by turning adjusting screw (6)

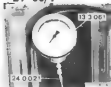
Check full throttle stop - see 12.73

Press accelerator pedal to final position

(fullthrottle)

The distance from leg (see 04) to screw (7)

must now be at least 44 mm (1.732")



24 00 011 CHECKING HYDRAULIC PRESSURE VALUES

Connect Special Tools 24 0 021 and 24 0 022



Remove pertinent plugs for testing:

1. Pump pressure
2. Clutch A
3. Converter pressure

rotation

Tightening torque*



A) Pump Pressure

Mount Special Tool 24 0 020 with a seal on the transmission.
Connect Special Tool 24 0 022 in conjunction with Special Tool 24 0 021.



B) Converter Pressure

Mount Special Tool 24 0 020 on the transmission.
Connect Special Tool 24 0 022 in conjunction with Special Tool 24 0 021.

Test	Pos.	Gear	Speed (rpm)	Pressure in bar (psi)
Pump	D	1	700 ... 1000	6.9 ... 7.5 (100 ... 107)
		3, 3.4	approx. 4000	4.6 ... 5.6 (66 ... 82)
	R	R	700 ... 1000	11 ... 13 (157 ... 185)
Converter pressure	D	4	Converter	max. 0.7 (10)



Check oil level with selector lever in P and engine running at idle speed, adding oil if necessary.

Car parked on level ground or floor.
Oil level should not be below ball (1) after a test drive and an oil temperature of approx. 30° C (160° F).
Oil level should be between min. and max. marks at an oil temperature of approx. 60° C (175° F).
Amount of oil between min. and max. marks is approx. 5.3 ltr (0.8 pint).
Never wipe off dipstick with a cloth before testing it.

Important*

Oil Dipstick Version with Lock
Oil dipstick can be pulled out only after tilting the grip.



Important

Oil Level Too High:
Strong foaming, splash loss, high temperature when driving test, oil lost via vent.

Oil Level Too Low:
Valves rattling, foaming, engine slipping when driving in curves, general operating disturbances.

Only pour in ATF with Special Tool 24 0 080 (funnel).



24 00 022 REMOVING AND INSTALLING TRANSMISSION

Disconnect battery ground lead

Precaution

Disconnecting the battery will cancel fault memories of the control units. Consequently always first read fault memories with a tester and print any faults.

M 30 Engine

Unscrew nut (1).

Disconnect throttle cable.

Precaution

Adjust throttle cable – see 24 00 006.

M 35 Engine

Unscrew nut (1).

Disconnect throttle cable.



M 37 Engine

Disconnect throttle cable.

Squeeze holders.

Pull out adjusting screw with throttle cable.



Remove exhaust assembly – see 14 00 020.

Remove heat shield (1).



Support transmission from underneath with Special Tools 24 0 120 and

Remove cross member (2).

Precaution

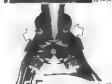
Center transmission – see Group 26. Tightening torque*



Version with Universal Joint: Unscrew propeller shaft on transmission.

Installation

Tighten nuts with specified tightening torque*



Version with Joint Disc:

Unscrew joint disc on transmission.



Installation

Replace stop nuts.

Tighten nuts and bolts with a standard 17 mm wrench socket and a torque wrench. Tightening torque*

* See Specifications

Version with Threaded Ring
Loosen threaded ring (1) several turns.

Installation

Tighten threaded ring (1) after complete installation, using Special Tool 24-5 210 Tightening torque:

Unthread center mount

Installation

Pushed center mount in forward direction by distance (A) with slide on center mount A = 4 - 8 mm. Without slide on center mount A = 2 - 4 mm. Raise propeller shaft down and pull it out of the transmission.

Important!

Prevent the propeller shaft from falling into the joints - suspend it from pin on a piece of wire.

Tightening torque:

Important! - Installation

Check condition of O-rings (1), replace them if necessary.

Unscrew nut (8) with selector lever in P.

Important!

Always counterhold on the ball with Special Tool 24-5 210 to avoid deformation of the cable.

Note

The special tool can only be applied with the selector lever in P.

Undo the cable from holder.
Pull cable out.

Installation

Tightening torque:

Adjust shift - refer to 24-00-005

Drain ATF

Important!

Never reuse drained ATF.

Installation

If ATF has a burnt odor and is black, the transmission will have to be disassembled.

Important!

If transmission is faulty, clean oil cooler and pipes with compressed air and flush twice with ATF.

Remove oil filter pipe (1).

Unscrew oil cooler pipe at transmission.
Tightening torque:

• Refer to Specifications

Only for Version with EH Transmission or Knockdown Interlock

Twist bayonet fastener (1) to the left.
Disconnect plug (2).
Pull wire harness out of the holder.

Installation

Connect plug (2) that the marks are aligned.

• Refer to Specifications

M20 and M21 Engines

Remove reinforcement
UnscREW Torx bolts with a Torx wrench
bolter**

Important! Installation
Washers must be used with the Torx bolts
to avoid increasing the breaking torque
torque
Tightening torque*

Remove protective grid

UnscREW torque converter from drive plate
at three points, turning the flywheel for this
purpose

Important! Installation
Only SAE M 10 x 18 mm bolts may be used
together with spring washers.
Non-conformance would lead to destruc-
tion of the transmission
Tightening torque*

M30 Engines

Remove cap from oil pan opening (1).
UnscREW torque converter from drive plate
at three points, using Special Tool 24 1 110
and turning the flywheel for this purpose



Installation
Install and tighten bolts using Special Tool
24 1 110 and a torque wrench
Tightening torque*

Important! Installation
Only SAE M 10 x 18 mm bolts may be used
together with spring washers.
Non-conformance would lead to destruc-
tion of the transmission



Lower transmission as far as possible and
unbolt 4 from the engine
UnscREW Torx bolts with a Torx wrench
bolter**

Important! Installation
Washers must be used with the Torx bolts
to avoid increasing the breaking torque
torque
Tightening torque*



Apply and clamp Special Tool 24 4 080 on
the transmission case to prevent the torque
converter from tilting out
Pull transmission off at the engine

Important!
The special tool jack, with mounted trans-
mission may only be moved in completely
corrected position

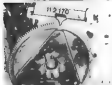


Important!
Ensure that drive sleeves (1 and 2) are not missing prior to installation of the transmission.
If necessary transfer the sleeves from the transmission or install new sleeves.



Important! - Installation
Check installed position of the torque converter — the drive ring must be seated below the case edge.

Note
Ensure that the converter remains in the installed position while assembling, using Special Tool (24-2300) to prevent it from sliding out if necessary.



Installation
Check drive plate for breaks and cracks, replacing it if necessary.

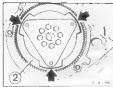
M20 and M21 Engines
Hold flywheel using Special Tool 11-2170.

Important!
Replace expansion bolts and insert new bolts with a bolt carrier**.
Only use the threads.
Clean the tapped holes thoroughly.
Tightening torque*



M20 Engines
Hold flywheel using Special Tool 11-2180.
Unscrew expansion bolts.

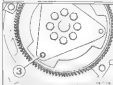
* Refer to Specifications
** Source of Supply: GM® Parts



Version with Sheet Metal Flywheel (2)

Important!
Keep to sequence of installation.
Sheet metal flywheel (2) has three indentations to take the mounting tabs of the torque converter.
The three mounting tabs of the torque converter must be aligned with the three indentations of the sheet metal flywheel while guiding the engine and transmission together.
Misalignment will cause follow-up damage on the automatic transmission.
Checking the torque converter or engine would no longer be possible after guiding together and leads to damage.

Turn the torque converter on the transmission so that hole (1) on the tab is aligned with the 8 mm dia. bore (2) in the transmission case.
Screw Special Tool (24-2300) into the tab.



Bore (3) on the drive plate must point to the center of the pin opening.



Fit the automatic transmission unit over (2) in the drive plate to match.
Guide the transmission into bore (3) of the drive plate carefully, using Special Tool (24-2300).
Unbolt the transmission case from the engine.
Screw Special Tool (24-2300) out of the tab towards the front.
Secure the torque converter.

24 00 042 INSTALLING EXCHANGE

Remove transmission - see 24 00 032.

Important!
Always clean oil cooler and pipes with air pressure and flush twice with ATF before installing an exchange transmission.

The transmission identification¹ is on the data plate:

Transfer (transporting) holder (1), lever (2) and bracket (3)

Transfer rubber mounts and exhaust holders.

Important! Installation:
Automatic transmissions are supplied filled with oil.
Remove plug on oil pump prior to installation of the oil filter pipe.
Catch escaping ATF in a clean container.

Pour in ATF again with help of Special Tool 24 0 080 (funnel) after installation of the transmission.



Check oil level with the selector lever in P, engine running at idle speed and car parked on level floor or ground, adding ATF if necessary.
Oil level should not be below level (1) after a test drive and with a transmission oil temperature of approx. 40° C (105° F).

Oil level should be between the min. and max. marks with an oil temperature of approx. 80° C (175° F).
Amount of oil between the min. and max. marks is approx. 0.3 ltr (3.4 pint).
Never wipe off the oil dipstick with a cloth losing lint.

Important:
Oil Level Too High
Strong foaming, splash loss, high temperature when driving fast, oil lost via

Oil Level Too Low
Valves rattling, roaring, engine stalling while driving in curves, general operating disturbances

Important:
Oil Dipstick Version with Lock.
The oil dipstick can be pulled out only after sliding the grip.



24-11 002 REMOVING AND INSTALLING OIL SUMP

Drain oil

Important!
Never reuse drained oil.

Precaution

The transmission will have to be disassembled, if the oil smokes burnt and is pitch black.

Unscrew oil filler pipe on the oil sump.
Unscrew oil sump.

Installation

Tightening torque*

Installation

Mount oil sump with the brackets in such a manner that the short leg presses on the oil sump.

Tightening torque*

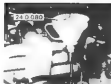
Important!

Both brackets with straight legs must be mounted on the sides.

Clean oil sump

Important!

Place magnets (1 and 2) in the oil sump.
Install gasket (3).



Pour In oil*

Important!

Special Tool 24-0-080 (funnel) must always be used to pour in ATP.

Check oil level with the selector lever in P, engine running at idle speed and car parked on level floor or ground, adding ATP if necessary.

Oil level should not be below ball (1) after a test drive and with a transmission oil temperature of approx. 40° C (105° F).

Oil level should be between the min. and max. marks with an oil temperature of approx. 80° C (175° F). Amount of oil between the min. and max. marks is approx. 0.3 ltr. (0.8 pint). Never wipe off the oil dipstick with a cloth losing lint.

Oil Level Too High

Strong foaming, splash loss, high temperature when driving fast, oil lost via the vent.

Oil Level Too Low

Valves rattling, foaming, engine stopping and general operating disturbances.

Important!

Oil Dipstick Version with Lock

The oil dipstick can be pulled out only after lifting the grip.



* See Specifications

* See Specifications



24 11 002 REMOVING AND INSTALLING OR SEALING TRANSMIS- SION EXTENSION

Unscrew propeller shaft - see
24 00 002.
Lift out lockplate (1)

Installation
Replace lockplate



Hold output flange with Special Tool
23 1 210
Unscrew collar nut with Special Tool
23 1 210
Roll off output flange

Installation
Tightening torque*



Support transmission with Special
Tools 24 0 120 and 00 3 000
Remove cross member with rubber
mounts
Lower the transmission

Installation
Center transmission - see Group 25
Tightening torque*



Unscrew transmission extension

Installation
Replace gasket (1)
Tightening torque*

* See Specifications

24-12/1



24 12 013 REPLACING RADIAL OIL SEAL FOR OUTPUT FLANGE

Unscrew propeller shaft — see 24 00 022
 LHM oil lockplate (1)
 Application
 Replace lockplate



Lubricate sealing lip with ATF
 Drive on radial oil seal with Special Tools
 See 24 12 014, 24 12 015, 24 12 016



Hold output flange with Special Tool
 33 0 020
 Unscrew collar nut with Special Tool
 33 1 210
 Pull off output flange
 Reassembly
 Tightening torque*

Replace radial oil seal for torque converter
 see 24 12 014 in Construction Group Repair
 Manual



Pull out radial oil seal with Special Tool
 00 5 010

* See Specifications



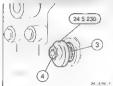
24 12 103 REPLACING RADIAL OIL SEAL FOR MANUAL SHIFT VALVE SHAFT

Disconnect selector lever (1) from the transmission

Precaution
Tightening torque



Remove radial oil seal (2) out using a screwdriver



Precaution
Lubricate the seating lip of the radial oil seal with ATF.
Apply Special Tool 24 S 230 on the selector lever shaft.
Remove lever mounting nut (4) onto the shaft.
Press radial oil seal (3) in using Special Tool 24 S 230 and with help of the nut.

24 30 003 REMOVING AND INSTALLING VALVE BODY

Remove oil pump - see 24 31 002.
Remove oil filter screen.

Installation
Check length of bolts - 65 mm long.
Tightening torque*

Remove valve body.
Unscrew Tors bolts with Special Tool 00 2 100.

Important:
Only unscrew bolts with ball head size A = 12 mm.

Installation
Bolts differ in length.
Bolt (1) = 65 mm long.
Bolt (2) = 60 mm long.

Installation
Tighten Tors bolts with Special Tools 00 2 100 and 00 2 050.
Tightening torque*

Installation
Mount valve body that clamp on selector valve can be connected in operating finger of pawl.
This requires pulling the transmission cable slightly so that throttle cam (2) cannot clamp on throttle pressure valve (3).

* See Specifications.



Install valve body and screw in bolts only finger tight.
Align valve body with Special Tool 24 3 050.
If this tool is not available, check that distance from valve body case to pin of throttle pressure piston is 11.5 mm (0.453").
Tighten valve body bolts.

Only Version with OH Transmission or Kickdown Preventer
Turn bypass fastener (1) to the left.
Put off plug (2).
Unscrew nut (3).

Installation
Connect plug (2) in such a manner that the marking lines are aligned.

Pull out socket toward inside.

Installation
Check O-ring (4), replacing if .
Plug in socket with the flat side facing out.
Tightening torque*

Note
Also mount the pulse sender on the valve body.
Tab on holder (1) must engage in the groove of plug.

* See Specifications.



24-31 HP REMOVING AND INSTALLING OIL PUMP FILTER SCREEN VALVE BODY

Remove oil pump - see 24-11-002

Remove oil filter screen

Precaution

Clean oil filter screen

Replace oil filter screen when it starts to

flam up with a burnt brown residue

Check length of bolts - 85 mm (2 5/8")

Tighten up. Torque*



Check rubber ring (1) replacing if necessary



Installation

Tighten Torx bolts with Special Tools

00 2 100 and 00 2 060

Tightening torque*



* See Specifications

24 32 002 REMOVING AND INSTALLING CENTRIFUGAL GOVERNOR

Remove transmission extension: yes

24 32 002

Pull off parking lock gear with centrifugal governor



24 32 005 DISASSEMBLING AND ASSEMBLING CENTRIFUGAL GOVERNOR

Centrifugal Governor Removed

Unscrew parking lock gear on centrifugal governor

Adjustment

Tightening torque*



24 32 001

Unscrew cover (1) on case (2)

Loft out pin (3) and remove washer (4). Remove governor piston (5) spring (6) and governor bushing (7).

Caution:

Governor piston must slide freely in governor bushing.

Remove spring (6) and balance weight (8).



2 x 24 32 004

24-34/1

24 34 002 REMOVING AND INSTALLING PARKING LOCK PAVL

Remove transmission extension - see
24 11 052
Loosen bolt (1)
Swing down holder (2)

Pull off pawl (3)
Caution!
Spring force

Installation
Check installed position of spring (4)
It must be possible to connect and off pawl (5) in both (3) of pawl

24 34 102 REPLACING THROTTLE CABLE

Engine M 20
Uncover nut (1) and disconnect throttle cable



Engine M 20

Uncover nut (1) and disconnect throttle cable



Engine M 21

Disconnect throttle cable
Compress return
Pull out adjusting screw with throttle cable



Remove valve body - see 24 30 002
Disconnect throttle cable



Press throttle cable out of case upwards
Press new throttle cable into case until
returner engages

24-34/2



Preload spring (1) for one turn clockwise with throttle cam (2)
Connect nipple on throttle cam



Install valve body
Insert Special Tool 24.3.050 between valve body case and throttle pressure valve
Push throttle cam against throttle pressure valve



Connect throttle cable on suspension on engine cover and holder (1)
Tighten cable
Squeeze upper lead seal on cable in distance (A) = 0.25 to 0.50 mm (0.010 to 0.020")
Adjust throttle cable - see 34.00.000
Distance (A) of the lead seal is the same for all other models



24 34 702 REPLACING SPRING FOR THROTTLE CABLE

Remove valve body - see 24.30.000
Disconnect selector lever (1) on transmission
Disconnect throttle cable



Drive out pin (2) in position W



Pull out selector shaft far enough that spring (3) can be removed



Use catalogues
Install selector shaft
Preload spring (3) for one turn clockwise with throttle cam (4)
Connect nipple on throttle cam



24 34 051 REPLACING ALL SOLENOID VALVES (RH) Valve Body Removed -

Testing - see BMW test plan in Group 24 Arrangement

- 1 Solenoid 1st/2nd and 3rd/4th gears
- 2 Solenoid 2nd/3rd gears
- 3 Solenoid converter lockup clutch
- 4 Solenoid reverse gear lock
- 5 Pressure regulator
- 6 Filter holder

a) Solenoid (1), 1st/2nd and 3rd/4th Gears
Unscrew governor housing (7)

Pull off wire plug

Unscrew Torx bolt with Special Tool

00 2 100

Take off holder

Pull out solenoid

Installation

Install holder with tabs facing collar on solenoid

Arrow on housing must be between plug pins

Tightening torque*

b) Solenoid (2) 2nd/3rd Gears

Pull off wire plug

Unscrew Torx bolt with Special Tool

00 2 100

Take off holder

Pull out solenoid

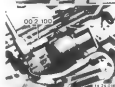
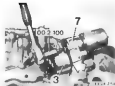
Installation

Install holder with tabs facing collar on solenoid

Arrow on housing must be between plug pins

Tightening torque*

* See Specifications



c) Solenoid (3) Converter Lockup Clutch
Unscrew governor housing (7)

Pull off wire plug

Unscrew Torx bolt with Special Tool

00 2 100

Take off holder

Pull out solenoid

Installation

Install holder with tabs facing collar on solenoid

Arrow on housing must be between plug pins

Tightening torque*

d) Solenoid (4) Reverse Gear Lock

Pull off wire plug

Unscrew Torx bolt with Special Tool

00 2 100

Take off holder

Pull out solenoid

Installation

Install holder with tabs facing collar on solenoid

Arrow on housing must be between plug pins

Tightening torque*

24 34 REPLACING SOLENOID FOR KICKDOWN/DOWNSHIFT PREVENTER Valve Body Removed

Testing - see BMW test plan in Group 24

Pull off wire plug

Unscrew Torx bolt with Special Tool

00 2 100

Take off holder

Pull out solenoid

Installation

Install holder with tabs facing collar on solenoid

Tightening torque*

* See Specifications



**24 34 660 REPLACING PRESSURE
REGULATOR**
Valve Body Removed *

Testing - see BMW test plan in Group 24
Pull off wire plug
Unscrew Torx bolts with Special Tool
00 2 100
Take off holder
Pull out pressure regulator (5)
Inspection
Align (7) on pressure regulator must be
aligned with rib (8)
Insert holder with tabs facing collar on
pressure regulator
Tightening torque*



24 34 670 REPLACING PULSE SENDER
- O-4 Sump Removed

Testing - see BMW test plan in Group 24
Unscrew Torx bolts (1 and 3) with Special
Tool 00 2 100
Take off holder (2)
Inspection
Engage tabs on holder (2) in grooves of
plug (4)

Pull out pulse sender
Pull off plug (4)
Installation
Tightening torque*

* See Specifications



24 35 500 REPLACING WIRE HARNESS FOR THE AUTOMATIC TRANSMISSION - Valve Body Removed

Pull off wire harness plugs on solenoids (1 - 4), pressure regulator (5) and pulse sender (6).

Left wire harness out of holders (see caution).

Check colors of wires:

Solenoid (1): gray/violet

Solenoid (2): green/violet

Solenoid (3): red/violet

Solenoid (4): orange/violet

Pressure regulator (5): blue/violet

Pulse sender (6): brown/brown

Push on plugs against the stop and check for tight fit.



24 35 501

24 35 502 REPLACING WIRE HARNESS FOR THE DOWNSHIFT PREVENTER - Valve Body Removed

Pull off plug on solenoid (1) and wire harness out of holders.



24 35 503

Route wire harness and clamp in holders.



24 35 504

Route wire harness and clamp in holders (7 - 10).



24 35 505

Turn valve body around.
Route wire harness and clamp in holders.



24 35 506

Turn valve body around.
Route wire harness and clamp in holders (11 - 14).



24-61-000 REMOVING AND INSTALLING OR REPLACING CONTROL UNIT (6H)

Control unit for the 6H transmission is located in the right A-prior.

Remove glove box - see 51 16 000.
Unscrew cover for radio speaker.
Pull off electric leads for radio speaker.



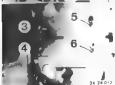
24-61-000



Pull off plug (1) on control unit, turning back spring retainer (2) for this gear post.

Important

The igni on must always be turned off first prior to a disconnection or connection of the plug.



Unscrew holder for insulation sheet.
Only loosen screws (3 - 6).



Lift and take out control unit toward the rear.



24 61 012 REPLACING CONTROL UNIT 24 61 014 FOR DOWNSHIFT PREVENTION (DH)

Testing - see BMW Test Plan in Ch. 34
The downshift prevention control unit prevents racing of the engine when operating the Motordom with the selector lever in D and at top speed. Downshift from 4th to 3rd gear is prevented by a solenoid in the transmission depending on the speedometer signal.

Downshifting is possible only after reduction of the road speed. When accelerating there is automatic upshifting from 3rd to 4th gear prior to the governed speed of the engine. Location: right A-pillar below the AFCS control unit.

The downshift prevention control unit is not installed since 8/88.

The DSS control unit is used to deactivate the solenoid.



Pull off protective cap (1) and plug (2).
Unscrew holder (3).

Downshift Prevention Control Unit

Model	Transm.	Version H	Bosch Number
520 iA, 524 iA			0 260 002 031
525 iA			0 260 002 032
528 iA			0 260 002 030



Unscrew cover for radio speaker.
Pull off electric leads for radio speaker.



Downshift Prevention Control Unit

Transm.	Version DH	Bosch Number
520 iA		
530 iA		
525 iA		

Replace lockdown switch - see 35 41 400
Replace program switch - see 61 31 245



Unscrew control unit on body.

Note:

See on-fig diagnosis or test plan for troubleshooting and testing electronic components.

TROUBLESHOOTING AUTOMATIC TRANSMISSION 4 HP 22 H + EH

Condition	Cause	Correction
Position P		
Park will not engage	Selector linkage between selector lever and transmission misadjusted	Adjust see 24-00-006
	Excessive friction in parking lock mechanism	Repair parking lock parts (transferring rod, pin(s)) 24-34-002
Park does not hold (slips out)	Selector linkage between selector lever and transmission misadjusted	Adjust see 24-00-006
Engine cannot be started in R or P or can be started in all positions	Selector linkage between selector lever and transmission misadjusted	Adjust see 24-00-006
	Transmission switch faulty	Replace transmission sw 24-35-16-040
	Start rel interlocking relay or supply lead faulty	Repair/replace relay or supply lead
Position R		
No reverse gear	Selector linkage between selector lever and transmission misadjusted	Adjust - see 24-00-006
	Oil filter screen dirty	Replace oil filter screen replace transmission in case of large contaminants in oil sample
	Clutch B destroyed, in this case also no 2nd gear	Disassemble clutch 24-23-022
	Brake D destroyed, in this case also no engine braking in position 1 1st gear	Disassemble clutch 24-23-022
	Clutch E destroyed, in this case also no engine braking in 2nd and 3rd gears as well as in position 1 1st gear	Disassemble clutch 24-23-022
	Reverse gear arrest does not cancel	Check transmission electronics Replace control unit 24-30-042
Slipping or shifting when moving off	Clutch B or E or brake D damaged	Disassemble clutch 24-23-022

TROUBLESHOOTING AUTOMATIC TRANSMISSION 4 HP 22 / H = 5H

Condition	Cause	Correction
Hard engaging gear (P / R or R / R) or defective double knock for P / R or R / R shift (engine speed < 1500 rpm)	Damper B defective (in 1st gear shift 2-3 also not correct)	Replace control unit 24-20 002 Check transmission electronics
Backup lights do not come on (electrical system okay)	Transmission switch faulty	Replace transmission switch 25-16 000
Gear moves in creep	Selector linkage between selector lever and transfer case misadjusted	Adjust - see 24-00 006
	Clutch A faulty (bonded)	Replace clutch A - see 24-23 022
Position D		
No power flow	Oil filter screen dirty	Replace oil filter screen 24-21 162 exchange transmission - in case of loss consultation at oil pump
	Clutch A defective	Replace clutch A - see 24-23 022
	Ty gear one-way clutch slips	Disassemble transmission 24-00 002
	Selector linkage between selector lever and transmission misadjusted	Adjust selector lever 24-00 006
Slipping or shaking when moving off	Clutch A damaged	Replace clutch A - see 24-23 022
Hard engaging gear (R / D) (engine speed < 1500 rpm)	Clutch A damaged	Replace clutch A - see 24-23 022
	Damper A faulty	Replace valve body 24-20 002
No shift (engine or cold start) - Shifts 1-2 / 3 - 1	Lockdown switch faulty (only lockdown shifts)	Replace lockdown switch 25-41 480
	Transmission electronics faulty	Check transmission electronics
	Solenoid valve (1) faulty	Replace solenoid valve 24-24 051
	Control valve 1 - 2 / 3 - 4 seized	Replace valve body 24-20 002
	Shift valve 1-2 seized	Replace valve body 24-20 002
	Governor dirty	Clean or replace governor 24-22 002
	Brake C and/or C faulty	Disassemble clutch 24-23 022
- Shifts 1 - 2		

Condition	Cause	Correction
Shift 2-3 / 3-2	Solenoid valve (2) faulty Shift valve 2-3 seized	Replace solenoid valve 24 34 851 Replace valve body 24 30 002
- Shift 3-3	Clutch B faulty	Replace clutch B - 24 23 022
- Shift 3-4 / 4-3	Solenoid valve (1) faulty Control valve 1-2 / 3-4 seized Shift valve 3-4 seized Governor dirty	Replace solenoid valve 24 34 851 Replace valve body 24 30 002 Replace valve body 24 30 002 Clean or replace governor 24 32 002
No shift (warm or cold start)	Brake F faulty	Disassemble clutches 24 23 022
Shift 3-4	Program switch faulty	Replace program switch 51 51 285
Shift 1-2 Engine speed does not increase full speed in drive and full load	Pulse transmitter faulty	Replace pulse transmitter 24 34 870
Can move off in 2nd gear	Transmission electronics faulty Solenoid valve (1) faulty Shift valve 1-2 seized Governor bushing seized	Check transmission electronics Replace solenoid valve 24 34 851 Replace valve body 24 30 002 Clean or replace governor 24 32 002
Can move off in 3rd gear	Transmission electronics faulty Solenoid valve (1) or (2) faulty Shift valve 1-2 and 3-2 seized Governor bushing seized	Check transmission electronics Replace solenoid valve 24 34 851 Exchange valve body Clean or replace governor 24 32 002
Can shift 1-3	Shift valve 3-2 seized Transmission electronics faulty Solenoid valve (2) faulty	Replace valve body 24 30 002 Check transmission electronics Replace solenoid valve 24 34 851

Condition	Cause	Correction
Shift Pumps		
Zero load shift not okay	Control unit faulty	Replace control unit 24 81 000
Full load shift gears not okay	Full load signal missing	Check throttle valve switch 13 83 544
	Throttle cable not okay	Check or adjust throttle cable 24 00 008
No kickdown shift	Kickdown sh ft faulty	Replace switch 35 41 480
	Throttle cable kickdown adjustment not correct	Adjust throttle cable kickdown 24 00 008
Only zero load shifts	Zero load switch or engine faulty	Check or replace zero load switch 13 88/554
Only kickdown shifts	Kickdown switch faulty	Replace switch 35 41 480
Shift Transaxles		
Zero load shifts too hard	Control unit faulty	Replace control unit 24 81 000
	Damper faulty	Replace valve body 24 30 002
	Modulation pressure too high	Replace valve body 24 30 002
	Plates damaged	Disassemble transax page 24 00 062
Full load and kickdown shifts too long	Control unit faulty	Replace control unit 24 81 000
	Damper faulty	Replace valve body 24 30 002
	Modulation pressure too low	Replace valve body 24 30 002
	Plates damaged	Disassemble transmission 24 00 062
Full load and kickdown shifts too hard	Modulation pressure not correct	Replace valve body 24 30 002
	Damper faulty	Replace valve body 24 30 002
	Control unit faulty	Replace control unit 24 81 000

Condition	Cause	Correction
<u>Position 3, 3rd Gear</u>		
No engine braking	Clutch E damaged	Disassemble clutches 24 23 002
<u>Position 3</u>		
Manual downshift 3-2 not okay	Locking valve 2 sticks	Replace valve body 24 30 003
	Governor sticks	Replace governor 24 32 002
	Transmission electronics faulty	Check transmission electronics
	Solennoid valve (2) faulty	Replace solenoid valve 24 34 051
No engine braking	Brake C or clutch E damaged	Disassemble clutches 24 23 002
<u>Position 1</u>		
Manual downshift 2-1 not okay	Locking valve 1 sticks	Replace valve body 24 30 003
	Governor sticks	Replace governor 24 32 002
	Transmission electronics faulty	Check transmission electronics
	Solennoid valve (1) faulty	Replace solenoid valve 24 34 051
No engine braking	Brake D or clutch E damaged	Disassemble clutches 24 23 002
<u>Torque Converter Lockup Clutch</u>		
Shift speed not correct	Converter hydraulic valve sticks	Replace valve body 24 30 003
	No 4th gear	Replace valve body 24 30 003
	Governor pressure not okay	Replace governor 24 32 002
	Control unit faulty	Replace control unit 24 61 000
Shift transition too hard	Converter damper faulty	Replace control unit 24 30 003
	Converter not okay (converter lockup clutch)	Replace converter 24 40 002

Condition	Cause	Correction
No shift	Valve body not okay Converter faulty No 4th gear Transmission electronics faulty Solenoid valve (3) faulty Converter faulty	Replace valve body 24 30 002 Replace converter 24 40 003 Replace valve body 24 30 002 Check transmission electronics Replace solenoid valve 24 34 851 Replace converter 24 40 003
Converter locked/clutch always closed (engine dies in driving position)	Transmission electronics faulty Solenoid valve (3) faulty	Check transmission electronics Replace solenoid valve 24 34 851
<u>General information</u>		
Shifts only in position	Transmission electronics faulty Program switch faulty	Check transmission electronics Replace program switch 61 31 255
Fault indicator lit/red	Transmission electronics faulty Solenoid valve (2) faulty	Check transmission electronics Replace solenoid valve 24 34 851
Fault indicator lights up while driving	Transmission electronics faulty Plug on transmission has poor contact	Check transmission electronics Check plug connection
Move and then power slip interruption after long drive	Oil filter screen or valve body dirty	Only replace oil filter screen when there are no burnt clutch lines or oil pump, otherwise exchange transmission
No power slip in forward or reverse, load noise	Drive plate between converter and engine torn off	Replace drive plate or converter 11 23 001 or 24 40 003
<u>Noise</u>		
Load noise in all positions, especially with cold oil Oil pump intake noise	Oil level too low Valve body leaks	Correct oil level Replace valve body 24 30 002

Condition	Cause	Correction
Load - screeching noise depending on speed in all positions, especially with warm oil - occurring after a long drive and sometimes accompanied by power flow interruptions	Oil filter screen dirty	Only replace oil filter screen when there are no clutch issues in oil pump - otherwise exchange transmission
Load noise when converter lockup clutch engages	Torque damper faulty	Replace converter 24 40 003
<u>Leakage</u>		
Oil dripping out of converter bell housing	Seal in pump housing damaged	Replace seal 24 31 002
	Pump housing leaks	Replace pump assembly 24 31 002
	Converter leaking at welded seam	Replace converter 24 40 003
	Reflex oil seal for torque converter leaks	Replace reflex oil seal 24 12 002
Leak between transmission case and oil pump	Oil pump retaining bolts not tightened correctly	Tighten bolts*
	Oil pump gasket damaged	Replace gasket 24 11 002
Leak between transfer plate and transmission case (especially in area of pump pressure bore)	Mounting bolts on converter bell housing loose	Tighten bolts*
Oil loss on transmission plug	O-ring defective	Replace O-ring 24 30 002
Oil loss on output	Radial oil seal on output damaged	Replace radial oil seal 24 12 013
Oil lost through or on vent	Oil level too high	Correct oil level
	Wrong oil (strong foaming)	Replace oil, if necessary remove transmission and drain complete oil including the torque converter oil
	Vent cap missing	Install cap or replace vent
	O-ring on vent damaged	Use the transmission extension - replace O-ring
	Pressure of output insufficient	Replace clutch

* See Specifications for tightening torque

Condition	Cause	Correction
Oil loss on cooler pipes	Connections loose	Tighten bolts*
	Cooler pipe damaged	Replace cooler pipe
	Cooler leaks	Replace cooler 12 11 000
Oil loss on transfer plate	Plug on transfer plate leaks	Tighten plug*
		Replace seal
Leak between transmission case and transmission in between	Mounting bolts loose	Tighten bolts*
	Gasket damaged	Replace gasket 24 11 002

* See Specifications for tightening torque

TROUBLESHOOTING VALVE BODY FOR 4 HP 22 / 12H

Note

Also refer to self diagnosis or test plan for troubleshooting and testing electronic components

Condition	Cause	Correction
Position B		
No reverse gear	Solenoid (H) faulty Wire to solenoid (H) grounded out Reverse gear locking valve seized Dumper B malfunctions	Replace solenoid valve 24 34 861 Replace wire harness 24 35 600 Replace valve body 24 30 002 Replace valve body 24 30 002
No reverse or forward gear	Main pressure valve seized, spring broken	Replace valve body 24 30 002
Intermittent power transmission	Pressure too low on clutch (B) or (E) brake D	Replace valve body 24 30 002
Hard jolt when moving into position B	Dumper B malfunctions Modulation pressure too high	Replace valve body 24 30 002
Position D		
No forward gear	Main pressure valve seized, spring broken	Replace valve body 24 30 002
Intermittent power transmission	Pressure too low on clutch A	Replace valve body 24 30 002
No shift function	Pulse sender faulty Wire to pulse sender grounded out	Replace pulse sender 24 34 870 Replace wire harness 24 35 600
No shift function 1-2 / 2-1	Solenoid (I) faulty Wire to solenoid (I) grounded out Shift valve 1-2, control valve 1-2/3-4, pressure reducing valve 1 seized	Replace solenoid valve 24 34 861 Replace wire harness 24 35 600 Replace valve body 24 30 002

Condition	Cause	Correction
Position D: No shift function 2 / 3 / 3 / 2	Solenoid (2) faulty Wire to solenoid (2) grounded out Shift valve 2-3 stuck	Replace solenoid valve 24 34 001 Replace wire harness 24 35 500 Replace valve body 24 30 002
No shift function 2 / 4 / 4 / 2	Solenoid (1) faulty Control valve 1 / 2 / 3-4 stuck	Replace solenoid valve 24 34 001 Replace valve body 24 30 002
Shifts 1-2 / 2-3 / 3-4 too long	Pressure regulator faulty Wire to pressure regulator grounded out Damper faulty Modulation valve (pressure reducing valves 1 and 2) stuck	Replace pressure regulator 24 34 000 Replace wire harness 24 35 500 Replace valve body 24 30 002 Replace valve body 24 30 002
Upshifts 1 / 2 / 3 / 3 / 3-4 too hard	Pressure regulator faulty Modulation valve sticks Damper faulty	Replace pressure regulator 24 34 000 Replace valve body 24 30 002 Replace valve body 24 30 002
Downshifts 4 / 3 too hard	Flap F dirty	Replace valve body 24 30 002
Manual downshifts 4-3 / 3 / 3 too hard	Damper E or G faulty	Replace valve body 24 30 002

Condition	Reason	Correction
Problems 1		
Manual downshift 2-1 not okay	Pressure regulator faulty Dampener D faulty Modulation valve sticks	Replace pressure regulator 24 34 000 Replace valve body 24 30 002 Replace valve body 24 30 002
Converter Lockup Clutch		
No converter clutch locking	Solenoid 131 faulty Converter clutch dampener faulty Converter pressure valve seized Pressure regulating valve 1 seized	Replace solenoid valve 24 34 001 Replace solenoid valve 24 34 001 Replace valve body 24 30 002 Replace valve body 24 30 002
No converter clutch unlocking	Solenoid 131 faulty Wire to solenoid 131 grounded out	Replace solenoid valve 24 34 001 Replace wire harness 24 35 500
Max pressure too high in all positions	Pressure regulator faulty Max pressure valve seized Modulation pressure too high	Replace pressure regulator 24 34 000 Replace valve body 24 30 002 Replace valve body 24 30 002

24 Automatic transmission

A4S 270 R / 310 R

00 11 239	Oil change in automatic transmission	24-	0/21
24 00 005	Shift lever - adjust	24-	0/23
015	Hydraulic pressure values - check	24-	0/24
025	Automatic transmission - remove and install	24-	0/25
045	Exchange transmission - install	24-	0/26
600	Converter bell housing and spring in selector unit - replace		
	intermediate case - seal	24-	0/29
601	Converter bell housing - replace		
	intermediate case - seal	24-	0/29
24 11 007	Transmission oil sumps, both - remove and install/seal or replace	24-	11/21
055	Transmission extension - remove and install/seal	24-	11/23
575	Converter bell housing - remove and install/seal	24-	11/24
24 12 015	Radial oil seal for output flange - replace	24-	12/21
105	Radial oil seal for manual shift valve shaft - replace	24-	12/21
505	Radial oil seal for torque converter (transmission removed) - replace	24-	12/24
24 31 155	Transmission oil strainer - remove and install or replace	24-	31/21
24 34 856	Solenoid valves, all - replace	24-	34/21
865	Pressure regulator for selector unit - replace	24-	34/23
875	Pulse generator (for output speed) - replace	24-	34/23
24 35 505	Wiring harness in automatic transmission - replace	24-	35/21
24 40 005	Torque converter - remove and install or replace	24-	40/21
24 61 500	Control Unit - remove and install or replace	24-	61/21
	Automatic transmission THM-R1 - troubleshoot	24-	90/21

00 11 329 Oil change in automatic transmission

Ensure that transmission is at 1/2 operating temperature before changing fluid



Run engine at idle speed in selector lever setting "P" or "N"

Car must be undriven and standing on a level surface

Interrogate ATF temperature with Service Tester or Modis (see Troubleshooting Manual)

Pull out dipstick out and measure fluid level

Compare measured level with value in the following table

Wipe dipstick clean with a lint-free cloth

Insertion with oil filler pipe

Extract dipstick

Caution:

Locking dipstick

Put the handle to unlock dipstick for removal

Remove drain plug (H)

Drain off fluid

Installation instruction

Replace seal

Tightening torque 24 11 642*

Top up ATF the 40** using special tool 24 0 560
Volume of ATF*

Oil temperature °C	Fluid level - H mm	
	Min.	Max.
30	9	15
35	9	17
40	8	20
45	11	22
50	13	25
55	14	26
60	16	27
65	17	28
70	19	29
75	21	30
80	23	34
85	24	36
90	26	38
95	28	41
100	31	43

* See Technical Data

** For grade of ATF fluid, see Consumables Specifications

* Refer to Specifications

Vehicle without oil filler pipe

With effect from 2011 the oil filler pipe was discontinued.

Use the filler opening on the lower side of the oil pan to replenish ATF.

**Remove drain plug (1)**

Drain off fluid

Installation instruction

Replace seal

Tightening torque 24 N·m (18.42^{*)}



To fill, attach filler neck (2)* to filler aperture

Add ATF until it overflows

Screw in filler plug

Tightening torque 24 N·m (18.42^{*)}

**Check ATF level, correcting if necessary**

Car must be unloaded and standing on a level surface.

Only check fluid level when temperature of fluid

temperature lies between 30... 32° C

Investigate ATF temperature with Service Tester or Multic (refer to Troubleshooting Manual)

Run engine at idle speed with selector lever in setting "P" or "R"

Unscrew filler plug (1)

Installation instruction

Check seal, replacing if necessary



Drain excessive ATF or add ATF if insufficient

To top up ATF, attach filler neck (2)* to filler aperture

Add ATF until it overflows

Screw in filler plug

Tightening torque 24 N·m (18.42^{*)}

ATF level too high

Sliding bearing, loss through splashing, high

temperature when driving fast

Fluid loss through vent

ATF level too low

Valve settle, bearing, transmission slip

General operating disturbances

* Refer to Specifications

* Source of Supply: BMW Parts Service

* Refer to Specifications



Set gearshift lever (1) to "P"
Release nut (2).

Caution!

In order to avoid deforming the operating cable, the clamping screw must be held with the special tool 24 5 210.

Note:

The special tool 24 5 210 can only be fitted in position "P".

Press forward lever (3) (park position).

Press operating cable rod (4) opposite forward direction and release again.

Firmly secure operating cable rod (4) with nut (2) (held with special tool 24 5 210).

For tightening torque 24 61 142 *

34 24 363 E



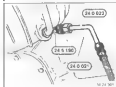
24 00 015 Checking hydraulic pressure values

Connect hose 24 0 021 to pressure gauge 13 3 081



Unscrew and remove plug (1) from the pressure test ball housing to check the main pressure

Caution!
Fresh threads



Screw in and tighten special tool 24 0 190 (adapter)

Secure gauge manifold 24 0 023 to adapter and connect to hose 24 0 021

Start engine
Selector lever setting "P" or "N"
Engine speed > 1500 rpm
Read off main pressure on pressure gauge
Main pressure specification: 8.8 - 10.8 bar

24 00 025 Removing and Installing Transmission

Disconnect negative lead

Caution!

First read fault memories with tester and print any faults as disconnecting the negative lead will cancel the fault memories in the control unit.

Use tester to read out fault memories and print out data on any errors prior to disconnecting battery.

Remove propshaft from transmission and carrier mount and fasten to one side.
Refer to 24 11 000.

Note

On version with heli carrier mounts, only dis-connect front carrier input.



Drain oil.
Never reuse drained ATF.

Note

Replace the transmission if the ATF smells burnt and is black.

Caution!

Clean oil cooler and pipes with compressed air and flush valve with ATF if the transmission is faulty.

Installation instruction

Replenishing ATF see 00 11 229



Remove selector lever

Move selector lever into setting "P".
Unscrew nut (1).

Caution!

Always counterhold both with special tool 24 5 210 to avoid deformation of the cable.

Note!

The special tool can only be fitted in setting "P".

Unscrew cable from holder.

Fit oil cable.

Tightening torque 25-30 Nm.

See installation instruction.

Adjust selector lever see 24 00 000.



Turn (against lock 10) counter-clockwise.
Pull off plug (2).
LFI cable harness out of holder.

Installation instruction

Fit plug (2) in such a way that marking lines are aligned with one another.



Pull plug (1) off oil speed sender.

* Refer to Specifications

- a. Unfasten torque converter screw connection.

Lift cover off aperture for torque converter to new connection.

Note

This aperture, depending upon model variant, is usually located under the engine or sump.

24 1 10 9

- b. On the side cover plate under the exhaust manifold.

Unfasten the screw connections on the torque converter using special tool 24 1 1 10. To do this, keep rotating engine as far as must come by turning the central screw on the crankshaft.

Caution!

Only use original bolts.

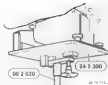
Installation instruction:

Tightening torque 24 40 1 A2*

- c. Lower transmission.

Proceed as follows 24 5 300 to suit TMM-R1 transmission as marked.

* Refer to Specifications



24 10 1 10

Support transmission from underneath with special tools 24 5 300 and 00 2 630.

If applicable, remove center of gravity suspension.



24 24 300 F

Unscrew cross member.

Installation instruction:
Centering transmission (refer to Group 24)
Tightening torque 24 71 1 A2*



24 24 300 G

Cylinder engine.

Before lowering transmission, insert spacer plate 23 1 330 between cross-member and oil pan.

Lower transmission.

* Refer to Specifications



24 24 310



24 1 1 10



24 24 3 10



24 00 14.1

24 00 045 Installing exchange transmission

Removing transmission 24 00 025.

Caution!

Always clean oil cover and pipes with compressed air and flush twice with ATF before installing an exchange transmission.
Transmission identification** on data plate.
Transfer bracket holder (1).



24 01 14.2

Transfer lever (2) and bracket (3).
Tightening torque 24 01 14.2*

Transfer rubber mounts and exhaust bracket.



24 14 14.3

Put oil filter pipe out of case.



Check sealing plug (4), replacing if necessary.

Caution!

Automatic transmission is supplied with a factory F8 of ATF.

For this reason, a fluid level check is not required until after the transmission has been installed (refer to 00 11 039).



24 24 14.4

Transfer with oil filter pipe.

Transfer oil filter pipe.
Unscrew bolts.

* Refer to Specifications
** Refer to Parts Catalog

24 00 600 Replacing converter bell housing and spring in selector unit, sealing intermediate case (A45 270R/310R)

Refer to Repair Manual 3 Series E36

24 00 601 Replacing converter bell housing, sealing intermediate case (A45 270R/310R)

Refer to Repair Manual 3 Series E36



24 11 007 Removing and installing sealing or replacing both transmission oil sumps

Drain oil.
Remove oil sumps

Remove magnet from the large oil sump and clean.
Remove gaskets and remove remaining pieces of gaskets



The screws are non-embossed and must be replaced after every disassembly. Only use screws with M10x50

Fit gaskets for oil sumps.
Fit magnet in large oil sump. Fit oil sumps in position and turn in all screws as far as it will go

Caution:
Do not tighten screws crosswise and do not retighten screws

Firmly tighten screws once one after the other in specified tightening torque*



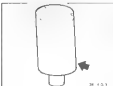
Fit with oil*

Caution!
Gear oil must only be filled using funnel 24 0 080.



Run engine at idle speed in selector lever position P or R.
Vehicle must be unladen and parked on even surface.
Check transmission oil temperature with Service Tester or MTCDC (refer to Test Manual).
Remove dipstick and measure oil level and compare in following table.
Only clean dipstick with first-line cloth

Oil temperature + °C	Oil level : h mm	
	Min	Max
20	3	10
25	5	17
30	8	20
35	11	23
40	12	25
45	14	26
50	16	27
55	17	28
60	18	29
65	21	32
70	22	34
75	24	36
80	26	38
85	29	41
90	31	43



Version with oil filter tube

Remove oil dipstick

Caution!
Oil dipstick with lock.
Dipstick can only be removed by lifting handle

* Refer to Technical Data

* Refer to Technical Data



Version without oil filter tube

The oil filter tube was discontinued after 2/91
Use the filter opening on the lower side of the oil pan to replenish ATF

Unscrew filter plug (1).

Installation:

Check seal, replacing if necessary



10 1 1 1



10 1 1 1

Hang filter (2) in filter opening

Add ATF until it overflows

Run engine at idle speed in selector level setting "R" or "N"

Car must be unladen and standing on a level surface

Add ATF until it overflows

Increase oil temperature to 30...35° C

Interrogate ATF temperature with Service Tester or MdiC (refer to Troubleshooting Manual)

Recheck ATF level, correcting if necessary

Screw in and tighten filter plug (1).

Tightening torque*

ATF level too high

Strong foaming, loss through splashing, high temperature when driving fast

Fluid loss through vent

ATF level too low

Valve noise, foaming, transmission slip

General operating disturbances

* Refer to Specifications

** Source of Supply: BMW Parts Service



24 11 055 Removing and installing cooling transmission extension

Remove propshaft, see 24 09 000.
Remove output flange.
Hold output flange with special tool 23 0 000.
Unscrew cover nut with a wrench socket.
Pull off output flange.



Pull plug off of speed sensor.
Remove transmission extension.
Unscrew bolts with special tool 24 5 100.
Caution!
Bolts have inch threads.
Remove transmission extension and gasket.

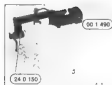


Install gasket with grease (Tosoline).
Mount transmission extension.
Use special tool 24 5 100.
Guide operating rod (1) for parking lock into pin (2).

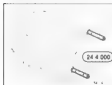
Caution!
Only use bolts with inch threads.
Tightening torque*
Mount and bolt output flange
Tightening torque*

24 11 575 Removing and installing sealing converter bell housing

Remove automatic transmission, refer to 24 30 025



Secure transmission to assembly frame 50 1 490 with mounting bracket 24 0 150



Pull torque converter out of oil pump carefully using special tool 24 4 500

Caution!
Escaping ATF

Installation
Carefully guide openings on converter into primary pump by turning slightly



Caution!
Do not damage converter mounting and sealing ring
Insert torque converter as far as stop

The torque converter has engaged correctly when the distance between case and torque converter bottom connection matches approx 21 mm



Set transmission upright
Lift out G-ring

Note
A slight quantity of oil will escape through the breather



Unscrew the eight outer screws in the torque converter bell housing

Caution!
Do not unscrew the two inner screws



Detach the converter bell housing from the adapter case with two screws (acrossdriver)

Carefully lift off converter bell housing



Fig. 11



Fig. 12

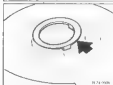


Fig. 13



Fig. 14

Once the screw connection has been untightened, also release the connection between adaptor case and front housing.

Do not unscrew this screw connection when removing the converter belt housing from the adaptor housing because the gasket cannot be replaced.

Fig. 15

A special disk is fitted to the oil pump. Refit the same spacer disk (i.e. one of the same color).

Attach spacer disk to oil pump with hexscrew.

Clean sealing faces and remove any oil which may have emerged from the threaded bore. Replace the sealing ring and gasket.

Installation instruction:

Attach gasket with hexscrew.

Ensure that recesses in paper gasket are located correctly.



Fig. 16



Fig. 17



Fig. 18

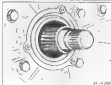


Fig. 19

Insert special tool 24.5.180 in two opposing

positions.

Fit converter belt housing and secure with five screws.

Remove special tool 24.5.180.

Tighten down the remaining screws.

Tightening torque 24.11.3a.2*

Fit new O-ring to the torque converter shaft.

Note:

If applicable, fit radial seal in torque converter see 24.12.5a.2.

* Refer to Specifications.



24 12 015 Replacing radial oil seal for output flange

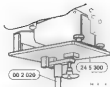
Unscrew propeller shaft - see 24 00 025.
Remove output flange.
Insert output flange with special tool 23 0 020.
Unscrew conical nut with a wrench socket.
Pull off output flange.



Lift out radial oil seal (1).

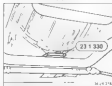


Lubricate assembly with ATF.
Drive in radial oil seal with special tool 23 1 370.
Mount and bolt output flange.
Tightening torque 24 21 142°.
Check oil level and top up if necessary.



24 12 025 Replacing radial oil seal for manual shift valve shaft

Remove propeller shaft, transmission plug and engine speed sensor plug.
Refer to 24 00 025.
Disport transmission from underneath with special tools 24 5 300 and 00 2 020.
Unscrew crossmember from body.



Before lowering transmission, insert spacer plate 23 1 330 between crossmember and oil pan.
Draw transmission as far as possible.



Remove shift control unit from main case.

Remove oil pan, refer to 24 11 027.
Remove oil screws.
Unscrew bolts with special tool 24 5 180.
Caution!
Bolts have imperial threads.

Inspection:
Check gasket between strainer and valve body.



Remove plugs (1 - 5) on solenoid valves.

Caution!
Pry off plug with a screwdriver.
Do not pull off plug on wires.
Pull out plug through hole in transfer case.
Unscrew nut on plug connection.
Pull out wiring harness.

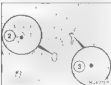


Unscrew cover for servo piston
Unscrew screws with special tool 24 5 185

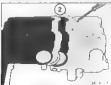
Caution!
Balls have ungender threads
Take off cover and gasket



Unscrew valve body on main case
Unscrew screws with special tool 24 5 185
Watch out for lockplate
Lift off valve body with gasket, pulling the
overrun valve connecting lever (2) off the part
Overrun valve should remain in the valve body

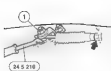


Push out for valve balls (2 and 3) on main
case



Unscrew transfer plate on valve body
Remove gasket
Replace gasket

Caution!
Watch out for valve ball (2)



Unscrew nut (1) in setting "P"

Caution!
Always brace bolt with special tool 24 5 210 to
avoid distortion of the cable

The special tool can only be fitted in setting
"P"
Unscrew cable from holder
Put out case
Remove lever from transmission

Preparation:
Adjust shift unit 24 90 006
Tightening torque 24 51 142"



Loosen nut (2)
Tension with pin
Drive out pin

Warning!
Nut (2) cannot be removed until shift has
been pressed out
Put shift element (4) off shift



Remove clamping pin (4) (side cutter)
Preparation
Replace pin

* Refer to Technical Data

Pull or press out shift valve shaft.

Installation:
If necessary, remove burr from shaft.



Remove old radial oil seal (5) with a screwdriver.



Lubricate shift valve shaft with oil and "grease" in case.
Fit radial seal (5) to case and drive lightly home with spanner (24 5 200).
Place shift element on shaft and screw on nut.

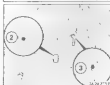


Hold groove of shaft tight with a suitable mandrel inserted through the bore.



Install pin (4) with the open end facing in and drive in.

Important!
Drive in pin only far enough that it can be removed again by pulling it out.
Place shift element on shaft.
Secure shift element with a nut or pin.
Tightening torque 24 52 1 A.2



Place two valve bodies in main case (use valve pin).
Check installed positions (2 and 3).



Secure gasket on case with a tight coat of grease (vaseline).
Screw in special tools 24 5 150.



Place valve body on main case.
Attach connecting lever (2) on overrun valve and operating lever.

Note:
Long arm for overrun valve, short arm for operating lever.

* Refer to Technical Data



Screw in bolts.
Remove centering pin 24 4 150.
Tighten valve body bolts crescental
Special tool 24 5 150

Note
Also secure lockplate (4)

Caution!
Only use screws with imperial thread
Tightening torque 24 50 1A2*



Bend on cable (1) for servo position
Special nut 24 5 150

Caution!
Only use bolts with imperial threads
Tightening torque 24 50 1A2*



Connect wire harness to solenoid valves
(1 - 5)

Note
Purge are coded



Mount and both steramer
Special tool 24 31 5A2*

Caution!
Only use bolts with imperial threads
Tightening torque 58 - 21 Nm

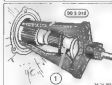
* Refer to Technical Data



24 12 505 Replace radial seal for
torque converter
(transmission removed)

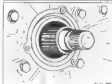
Pull torque converter out of oil pump carefully
using assembly handles 24 4 000

Caution!
Escaping ATF



Unscrew Torx bolts with a Torx socket
90 5 018
Pull out radial oil seal with extractor tool
00 5 010

Place a suitable pressure plate (1) on the
input shaft on which the pressure bolt can
bear



Lubricate sealing lip with ATF
Insert radial oil seal
Tightening torque 3 Nm



24 30 - REMOVING AND INSTALLING BOTH VALVE BODIES

Remove both oil sumps - 24 11 007
Unscrew oil filter screen.
Unscrew bolts with Special Tool
24 5 180.
Important!
Bolts have inch threads.

Installation
Check gasket between oil filter screen
and valve body.

Pull off plugs (1 - 5) on solenoids

Important!
Pry off plugs with a screwdriver -
don't pull off on electric leads.

Pull out plugs through bore in transfer
case.
Unscrew nut on plug connector.
Pull out wire harness.



Unscrew valve body on transfer case.
Unscrew bolts with Special Tool
24 5 180.

Important!
Bolts have inch threads.

Take off valve body.

Important!
Check installed position of gasket,
transfer plate and gasket.
Check ball valve (1) in transfer case.



Unscrew cover for pump piston.
Unscrew bolts with Special Tool
24 5 180.

Important!
Bolts have inch threads.

Take off cover and gasket.

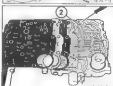


Unscrew valve body on main case.
Unscrew bolts with Special Tool
24 5 180.

Check plate for the lock.
Lift off valve body with gasket, pulling
the connecting lever (3) for the closing
valve off of the locking panel at the
same time.
Closing valve should remain in the
valve body.



Check ball valves (2 and 3) in main
case.



Unscrew transfer plate on valve body.
Take off gasket.
Replace gasket.

Important!
Check ball valve (2).



Mount gasket and transfer plate, and
center with Special Tools 24 5 140.
Screw in and tighten bolts.

Important!
Only use bolts with inch threads.
Tightening torque = 13 Nm (9 ft. lbs.)
Removing special tool centering pins.



Place two ball valves in main case (with vaseline).
Check locations (2 and 3).



Mount gasket on case with a light coat of grease (vaseline).
Screw in Special Tools 24-5-150.



Place valve body on main case.
Attach connecting lever (3) on coasting valve and operating lever.

Note
Long arm faces the coasting valve, short arm faces the operating lever.



Screw in bolts.
Remove Special Tools 24-1-150.
Tighten bolts of valve body crosswise.
Use Special Tool 24-5-180.

Note
Also bolt down lockplate (4).

Important!
Only use bolts with inch threads.
Tightening torque = 20 Nm (14 ft. lbs.).



Mount cover (1) for the servo piston.
Use Special Tool 24-5-150.

Important!
Only use bolts with inch threads.
Tightening torque = 20 Nm (14 ft. lbs.).



Place ball valves in transfer case (with vaseline).
Check location (1).

Important!
Install gasket (2) with oval opening (3) facing the ball valve.
Install transfer plate (4) and second gasket (5).



Screw in Special Tools 24-5-150.
Place valve body on transfer case.
Screw in bolts.
Remove Special Tools 24-5-150.
Tighten bolts of valve body crosswise.
Use Special Tool 24-5-180.

Important!
Only use bolts with inch threads.
Tightening torque = 20 Nm (14 ft. lbs.).



Connect wire harness on solenoids (1-5).
Pugs are coded.

24-30/23

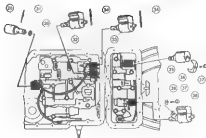


Install and secure on oil filter screen.
Use Special Tool 24-5-180

Important!

Only use bolts with inch threads
Tightening torque = 18 ... 21 Nm
(13 ... 15 ft. lbs.)

24-34 856 Replacing all solenoid valves (all parts removed)



Arrangement of solenoid valve

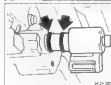
- 26 Solenoid valve, torque converter clutch
- 27 Screw, 1 x 1/2"
- 28 Disc
- 29 Pressure regulator
- 30 Spring pin
- 31 Pin
- 32 Solenoid switch stage 2-3
- 33 Solenoid switch stage 1-2 and 3-4
- 34 Corrugated disc
- 35 Solenoid valve, torque converter clutch



1st Solenoid valve (32) 1st/2nd gear

Press off plug (1) with screwdriver.
Do not pull on wires.
Pull out pin (2) (use side cutters).

Installation
Replace pin (2).
Pin must protrude about 3 mm.



Pull or press (just screwdriver) out solenoid valve.

Installation
Coat seals with grease (vaseline).
Press in solenoid valve as far as stop.



3rd Solenoid valve (32) 1st/2nd and 3rd/4th gear

Press off plug (1) with screwdriver.
Do not pull on wires.
Pull out pin (2) (use side cutters).

Installation
Replace clamping pin (2).
Pin must protrude about 3 mm.



Pull or press (just screwdriver) out solenoid valve.

Installation
Coat seals with grease (vaseline).
Press in solenoid valve as far as stop.



c) Solenoid valve (29) brake band

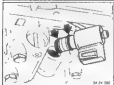
Remove air screen (24-34-155).
Press off plug (1) with screwdriver.
Do not pull on wires.
Press in solenoid valve. Tight spring pressure
and pull out pin (2) by hand or with a pliers if
necessary.



Pull out solenoid valve.
Avoid damage to corrugated washer (3).



Installation
Coat seals with grease (vaseline).
Install solenoid valve that groove (4) is aligned
with bore (3).
Press in solenoid valve that pin (2) can be in-
serted.



d) Solenoid valve (29) torque converter clutch

Press off plug (1) with screwdriver.
Do not pull on wires.
Remove screw (2).

Important:
Important threads



Pull or press (use screwdriver) out solenoid
valve.

Installation
Coat seals with grease (vaseline).
Press in solenoid valve as far as stop and
tighten screw.
Tightening torque (24-34-3A.2)*



24 34 885 Replacing pressure regulator for selecting unit (Oil sump removed)

Disconnect cables (1 and 2).
Remove screw (3).

Caution!
Tech Thread
Remove support bracket (H).
Pull out pressure regulator.

Installation note

Fit pressure regulator in position.
Support bracket (H) must be fitted and secured
with curved section facing outward.
For tightening torque 24 34 8A2.



24 34 875 Replacing pulse generator (for output speed)

Disconnect plug (11).
Remove screw (2).

Pull out or press out pulse generator.

Installation note:
Cool during (3) with grease (Kisseline).

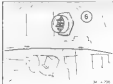




24-35-505 Replacing wiring harness on automatic transmission

Remove as shown (4-3/1 55).
Remove plugs (1 - 5) from the splined valves.

Caution!
Dry off plug with a screwdriver.
Do not pull on wires.



Unscrew nut (6) from plug.
Withdraw plug from inside.

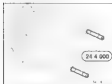


Installation:
Check seal (7).
Place flattened side of plug facing upwards.
Tightening torque 24-20-1 52*



Pull out wire harness through bore in transfer case.

* Refer to Technical Data



24 40 005 Removing and installing or removing torque converter

Remove transmission, refer to 24 00 025.
Pull torque converter out of primary pump carefully using assembly handle 24 4 000.

Caution!
Escaping ATP



Installation

Check torque converter for leaks using fixture 24 4 050, retaining bracket 24 4 043 and retaining screws 24 4 044.
Test pressure: 0,5 bar

Caution!
Danger of injury - always use special tool 24 4 043

Torque converter must be replaced if the bearing surface on the converter shaft is damaged



Carefully guide openings on converter into primary pump by turning slightly and using assembly handle 24 4 000

Caution!
Make sure converter bearings and seal are not damaged while guiding in
Insert torque converter as far as stop



Checking installed torque converter
Engine and transmission oil must be at operating temperature
Engine must develop full power
Start engine
Pull up parking brake lever and press down on brake pedal firmly
Move selector lever to 'D'
Press accelerator pedal to maximum
Read oil speed* off tachometer

Caution!
Never test stall speed longer than six seconds to avoid overheating. Stall speed much higher than specified value
a) Torque converter not sufficiently filled
Top up the oil level
b) Slip in the clutches
→ Check the clutches

Stall speed much lower than specified value*
a) Engine not developing sufficient power
Check engine

b) Torque converter or pump defective.
Replace torque converter or check pump



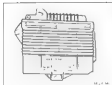
Torque converters cannot be cleaned with standard washing equipment and must be replaced in case of transmission damage or torn oil seal
Converter - certification*

* Refer to Technical Data



24-61/550 Removing and installing or replacing control unit

The control unit for SH compressors is located in the A-pillar on the right side.
 Removing and installing glovebox 24-61/18
 Lift off cover for outspeaker
 Disconnect wires for outspeaker



Code is an identification plate.
 Refer to BMW Parts catalog for cross reference of types and models



Pull plug (1) off at control unit, swinging spring retainer (2) down for this purpose

Caution!
 Always switch ignition off first before disconnecting or connecting plug



Partially remove insulating mat.
 Only loosen screws (1 - 5)



Lift out control unit and remove from under side.

TROUBLESHOOTING AUTOMATIC TRANSMISSION THW-R1



See self-diagnosis or test plan for troubleshooting and testing electronic components.

Condition	Cause	Correction
Engine cannot be started in N or P or in all positions	Selector lever not in N or P Misadjustment between selector lever and transmission Transmission switch faulty	Move selector lever to N or P Adjust selector lever - see 24-00-007 Replace transmission switch - see 23-10-060
Position P Park does not engage	Misadjustment between selector lever and transmission (Excessive friction in parking lock mechanism)	Adjust selector lever - see 24-00-007 Replace parking lock parts (connecting rod, pin(s))
Park does not hold (slips out)	Misadjustment between selector lever and transmission	Adjust selector lever - see 24-00-007
Delayed shift from N to D	Oil level in transmission too low Oil pressure too low	Correct oil level Check oil pressure - see 24-00-015
Slip or shake in 1st gear	Oil pressure too low Torque converter faulty Brake band misadjusted Oil loss in oil circuit for the brake band 4th gear one-way clutch or panel gear set one-way clutch faulty	Check oil pressure - see 24-00-015 Replace converter - see 24-40-005 Adjust brake band Check brake band piston and cover for leaks/seal Replace one-way clutches

TROUBLESHOOTING AUTOMATIC TRANSMISSION THM-R1

Condition	Cause	Correction
Position R No reverse gear	Misadjustment between selector lever and transmission Reverse gear clutch faulty Oil filter screen dirty	Adjust selector lever - see 24 00 007 Repair reverse gear clutch Replace oil filter screen
Car moves or creeps in R	Misadjustment between selector lever and transmission Brake band adjusted too tight	Adjust selector lever - see 24 00 007 Adjust brake band
Hard engaging jolt from R to D	Brake band locked or faulty	Check/replace brake band
Poor acceleration	Emergency running program activated Torque converter faulty	Check self-diagnosis Replace converter - see 24 00 008
No upshift 1-2	Misadjustment between selector lever and transmission Oil loss in 2nd gear clutch Solenoid/electric lead faulty	Adjust selector lever - see 24 00 007 Seal piston of 2nd gear clutch Check lead/replace solenoid - see 24 24 006
Problems with 1-2 shift	Wrong oil pressure for 2nd gear clutch Oil loss in 2nd gear clutch Pressure reservoir valve for 1/2 gear clutch seized or leaks	Seal piston of 2nd gear clutch Replace valve body
No upshift 2-3	Misadjustment between selector lever and transmission Solenoid/electric lead faulty Shift valve in valve body faulty	Adjust selector lever - see 24 00 007 Check lead/replace solenoid - see 24 24 006 Replace valve body
Problems with 2-3 shift	Brake band misadjusted Brake band valve faulty/seized Oil loss in 2nd gear clutch Oil loss in return pipe of pressure reservoir for 2nd gear Wrong oil pressure	Adjust brake band Seal piston of 2nd gear clutch

TROUBLESHOOTING AUTOMATIC TRANSMISSION THM-R1

Condition	Cause	Correction
No upshift 3-4	<p>Maladjustment between selector lever and transmission</p> <p>Oil loss in 3rd gear clutch</p> <p>Solenoid-electric lead faulty</p>	<p>Adjust selector lever - see 24-60 007</p> <p>Seal piston of 3rd gear clutch</p> <p>Check lead/replace solenoid - see 24-34 056</p>
Problems with 3-4 shift	<p>Oil loss in 4th gear clutch</p> <p>Wrong oil pressure</p> <p>4th gear overdrive clutch does not disengage</p>	<p>Seal piston of 4th gear clutch</p> <p>Repair overdrive clutch</p>
No braking of converter clutch	<p>Solenoid-electric lead faulty</p> <p>Oil leak in oil circuit</p>	Check lead/replace solenoid - see 24-34 056
Rattling from converter clutch	<p>Converter faulty</p> <p>Insufficient oil pressure</p>	<p>Replace converter - see 24-40 005</p> <p>Check oil pressure - see 24-60 015</p>
Converter clutch does not disengage	<p>Solenoid-electric lead faulty</p> <p>Return pipe clogged</p>	Check lead/replace solenoid - see 24-34 056
No "S" program	<p>Program switch faulty</p> <p>Break in electric lead</p>	<p>Replace program switch - see 61-21 265</p> <p>Check - repair electric lead</p>
No "M" program	<p>Program switch faulty</p> <p>Break in electric lead</p>	<p>Replace program switch - see 61-21 265</p> <p>Check - repair electric lead</p>
No lockdown	<p>Lockdown switch faulty</p> <p>Break in electric lead</p>	<p>Replace lockdown switch - see 35-41 480</p> <p>Check - repair electric lead</p>

TROUBLESHOOTING AUTOMATIC TRANSMISSION THM-R1

Condition	Cause	Correction
No downshift	1/2 and 3/2 solenoids or electric lead faulty Shift valves in valve body faulty	Check electric lead/replace solenoids – see 24 34 636 Replace valve body
No engine braking effect Selector lever in D (3rd gear) M program / selector lever in 3, 2, 1	4th gear overdrive clutch faulty Oil loss in oil circuit	Repair overdrive clutch
ATF temperature too high Oil escapes through vent	Oil level too high No function of converter clutch Emergency lead in emergency running program or M program	Correct oil level Replace solenoid for converter lockup clutch / check electric lead

TROUBLESHOOTING AUTOMATIC TRANSMISSION THM-R1

Condition	Cause	Correction
Oil drips out of converter bell housing	O-ring of input shaft faulty Pump housing leaks Converter leaks on welded seams Radial oil seal for converter leaks	Replace O-ring Replace complete pump - see 24 31 Replace converter - see 24 40 000 Replace radial oil seal - see 24 12 000
Leak between transmission case and oil pump	Oil pump mounting bolts not tightened correctly Oil pump gasket damaged	Tighten bolts to correct torque* Replace gasket - see 24 11 007
Leak on transfer case	Converter bell housing mounting bolts loose Case gaskets faulty	Tighten bolts to correct torque* Seal case
Oil leak on transmission plug	O-ring faulty Transmission plug not tight	Replace O-ring - see 24 30 Tighten transmission plug
Oil leak on output	Radial oil seal on output damaged	Replace radial oil seal - see 24 12 010
Oil leak through or on vent	Oil level too high Wrong oil (wrong converter) Vent cover missing O-ring on vent damaged	Correct oil level Replace oil, if necessary remove transmission and drain completely including torque converter Mount cover or replace vent Replace O-ring
Oil leak on filler pipe	Plug on filler pipe faulty	Replace plug
Leak between transmission case and extension	Mounting bolts loose Gasket damaged	Tighten bolts to correct torque* Replace gasket - see 24 11 000
Oil leak on oil cooler pipe	Connection loose Oil cooler pipe damaged Cooler leaks	Tighten to correct torque* Replace oil cooler pipe Replace cooler - see 17 11 000

* See Specifications

24 Automatic transmission

A5S 310 Z

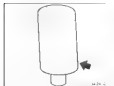
00 11 239	Oil change in automatic transmission	24	0/300
24 00 007	Selector lever – adjust	24-	0/302
016	Hydraulic pressure value – check	24-	0/303
026	Transmission – remove and install – engine M50 /M51 transmission A5S 310 Z	24-	0/304
026	Transmission – remove and install – engine M60 transmission A5S 310 Z	24-	0/310
026	Transmission with transfer box – remove and install – 4-wheel drive	24-	0/321
046	Exchange transmission – install	24-	0/326
24 11 008	Transmission oil pan – remove and install/seal	24-	11/31
24 12 016	Radial seal for output flange – replace	24-	12/31
106	Radial seal for manual selector valve shaft – replace	24-	12/33
24 13 166	Output flange – replace	24-	13/31
706	Bearing on transmission extension – replace	24-	13/31
24 30 006	Shift unit – remove and install/replace	24-	30/31
24 31 020	Oil pump housing – remove and install/seal	24-	31/31
166	Transmission oil strainer – remove and install/replace	24-	31/32
24 34 006	Parking interlock (pawl / leg spring) – remove and install/replace	24-	34/31
653	All solenoid valves – replace	24-	34/32
661	Shift unit pressure regulator – replace	24-	34/33
671	Impulse sensor for output speed – replace	24-	34/33
672	Impulse sensor for turbine speed – replace	24-	34/33
24 35 501	Wiring harness in automatic transmission – replace	24-	35/31
24 40 006	Torque converter – remove and install/replace	24-	40/31
24 61 500	Control unit – remove and install/replace	24-	61/31
	Automatic transmission – troubleshoot	24	93/31
	Shift unit – troubleshoot	24-	93/36
	Peripherals – troubleshoot	24-	93/12

24 11 038 CHANGING OIL IN AUTOMATIC TRANSMISSION

Version with Oil Filter Pipe

WARNING

The oil change should only be carried out at operating temperature



Pull out oil dipstick

Note:

The oil dipstick with arrest can only be pulled out after filling the grip



Insert the plug 13
Close ATF

Installation
Replace seal
Tightening torque*



Pour in ATF only with help of Special Tool
24 0 080
"Sump of ATF"

* Refer to Specifications



H

Check correct ATF level with selector lever in P at 0 and engine running at idling speed

Car must be on a level surface
Wipe off oil dipstick with a rag which does not lose lint

ATF temperature is sensed by a temperature dependent resistor which is integrated in the transmission wire harness

Read ATF temperature with MoDo or a Service Tester (refer to Test Plans)
Pull out oil dipstick and measure oil level and compare with value in this table

Oil Temperature + °C	ATF Level ± ml in each	
	-60m	60m
30	3	18
40	8	23
50	12	28
60	16	33
70	21	38
80	26	43
90	31	48

ATF Level Too High

Strong foaming, splash loss, high temperature when driving fast
Oil lost via the vent

ATF Level Too Low

Valve rattle, foaming, engine spins
Gears disturbed

Version without Oil Filter Pipe

The oil filter pipe has been omitted since 1/80.
ATF is poured in and ATF level is checked through a filler bore underneath the oil pump.
The oil change should only be carried out at operating temperature.



Car must be on level surface.
With the engine stopped, pour in ATF using that adaptor (32*) until it runs out of the spill bore.
Don't plug the bore.
Start engine and move the selector lever in and out of all ranges while operating the brake pedal.

ATF temperature must be 30 to 50 °C.

Interrogate ATF temperature with MoHC or a Service Tester (refer to Test Plan).
Run engine at idling speed with selector lever in "P" or "R".
Recheck ATF level.
Screw in filler plug.
Tightening torque†



Unscrew drain plug (1).
Drain ATF.

Note:
Dispose old ATF properly.

Installation:
Replace seal.
Tightening torque†



Fill transmission with ATF.

ATF** is poured in through the filler bore underneath the oil pump.
Unscrew filler plug (2).

Installation:
Check seal, replacing it if necessary.

† Refer to Specifications.
** Refer to Operating Fluids.

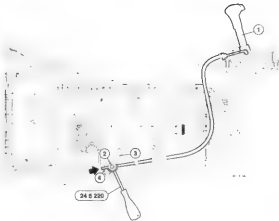
† Refer to Specifications.
** Source of Supply: BMW Parts.

24-00 007 Adjusting gearshift lever

Transmission A5S 316 Z

Set gearshift lever (1) to "P"
Release nut (2).

Caution!
In order to avoid deforming the operating cable, the clamping screw must be hand with the special tool 24 5 220.



Note
The special tool 24 5 220 can only be fitted in position "P".

Press forward lever (3) (park position).

Press operating cable rod (4) opposite forward direction and release again.

Firmly secure operating cable rod (4) with nut (2) (held with special tool 24 5 220).

Close up tightening output 18 12 Nm



24 00 016 CHECKING HYDRAULIC PRESSURE VALUES

Connect Special Tools 24 0 021 and 13 0 001

Unscrew and remove plug (1) from the right-hand side of the transmission case to check the main pressure identification on case PH.

Important!

Check seal, replacing it if necessary.
Tightening torque*



Fig. 24 000 0



Fig. 24 001 0

Screw in Special Tool 24 0 022 with feeling until resistance is noticed (adapter if heads are tapered).

Mount Special Tool 24 1 140 (yellow pipe) on Special Tool 24 0 022 (adapter) and connect with Special Tool 24 0 021 (pneum.)

Select lever in P or R

Start and run engine at idling speed*

Read main pressure on pressure gauge

Main pressure specification: 0.8 - 0.4 bar

* Refer to Specifications



24-00-026 Removing and installing transmission

• Engines M50 M51 transmission
A55 350 Z

Disconnect negative lead

Caution!

First read fault memories with tester and print any faults since disconnecting the negative lead will cancel the fault memories in the control units

Remove the complete exhaust unit 19 00 000
Remove heat baffle plate (1).

Remove bracket (2).

Installation instruction:
Tightening torque*



Detach propeller shaft on transmission.

Installation instruction:

Replace stop nuts.

Tighten nuts with specified tightening torque*



Version with screwed-on ring

Loosen screwed-on ring (1) several turns

Installation instruction:

Tighten screwed-on ring (1) with spanner tool 28 1 640 after finishing installation.

Tightening torque*

Press joint disk away from transmission

* Refer to Specifications



Unscrew center mount

Installation instruction:

Press center mount in direction of travel (A)

With sliding member on center mount

d = 4 - 6 mm

Without sliding member on center mount

d = 2 - 4 mm

First propeller shaft downwards and withdraw from transmission

Caution!

Do not allow the propeller shaft to drop into the joint

Suspend propeller shaft from car on a piece of wire

Tightening torque*



Drain ATF

Caution!

Never reuse drained ATF

Installation instruction:

Transmission must be replaced if ATF smells burnt and is black

Caution!

Clean oil cooler and pipes with compressed air and flush twice with ATF if the transmission is faulty

Remove oil filter pipe (1)

Install new filter

Tightening torque*

* Refer to Specifications



Unthread Nut (1)

Important!
Always counterhold bolt with Special Tool 24 0 290 to prevent deformation of the cable.

Note
Special Tool 24 0 290 can be applied only in position B.

Unscrew cable at handle.
Pull out cable.

Installation
Adjust selector lever - see 24 00 008.
Tightening torque*



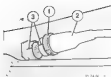
Unscrew holder (1) for oil cooler pipe.

Installation
Tightening torque*



Pull oil cooler pipe out of transmission.

Installation
Check O-rings (2), replacing them if necessary.
Tightening torque*

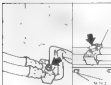


Turn beveler lock (1) counterclockwise.
Pull off plug (2).
Lift wire harness out of holder.

Installation
Connect plug (2) if hot media (3) are aligned.

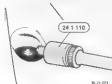


Lift cap off opening (1) in oil pump.
Unscrew torque converter from drive plate at three points using Special Tool 24 1 110.
Turn flywheel for this purpose.



Unscrew oil cooler pipe clamps on crankcase and oil pump.

Installation
Tightening torque*



Installation
Insert bolt with Special Tool 24 1 110 and tighten with a torque wrench.
Tightening torque*

Important!
Only use the M 10 x 16 mm bolts together with spring washers.
Non-conformance leads to destruction of the transmission.

* Refer to Specifications

30 21 004

* Refer to Specifications



24 0 717

Unscrew stabilizer on engine carrier on left and right hand sides.

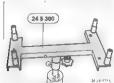
Installation
Tightening torque*



24 0 306

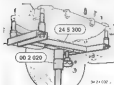
Remove gravity center mount

Precaution
Rubber mounts must be adapted by moving after installation of the rear cross member
Tightening torque*



24 0 774

Assemble Special Tool 24 5 300 to suit a 5 HP-68 transmission as marked



24 2 020

Support transmission from underneath with Special Tools 24 5 300 and 24 2 020

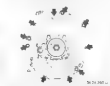
* Refer to Specifications



24 0 306

Unscrew cross member
Lower transmission as far as connecting pipe.

Installation
Center transmission - see Group 26
Tightening torque*



24 0 306

Unscrew transmission on engine
Unscrew Torx bolts with a Torx socket

Important!
Washers must be used to avoid increasing the breaking loose torque
Tightening torque*



24 0 306

Prevent converter from sliding out by applying and clamping Special Tool 24 4 000 on transmission case with flat side of retainer (1) facing the converter. Put transmission off of engine.

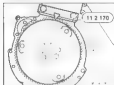
Important!
The lifting fixture with mounted transmission may be moved only in completely lowered state.



24 0 306

Important!
Check that dowel sleeves (1 and 2) are not missing before installing transmission.
If applicable, transfer dowel sleeves from transmission or use new dowel sleeves.

* Refer to Specifications



Installation
Check drive plate for tears and marks, replacing it if necessary.
Held flywheel using Special Tool 31 2 170.

Important!
Replace expansion bolts and install new bolts with apt cement!
Only coat threads.
Clean tapped holes thoroughly
Tightening torque*



Version with Sheet Metal Flywheel (2).

Important!
Keep to sequence of installation.
Sheet metal flywheel (2) has three indentations for the torque converter mounting tabs.

When guiding the engine and transmission together the three mounting tabs on the torque converter must be aligned with the three indentations in the sheet metal flywheel.

Non-conformance will lead to follow-up damage on the automatic transmission, tearing of the torque converter, or engine is no longer possible after guiding the engine and transmission together and would lead to damage.



Turn torque converter on the transmission and bore (3) in the top points down perpendicular.
Screw Special Tool 34 2 300 into the tab.

* Refer to Specifications
** Source of Supply: BMW Parts



Bore (3) on drive plate must point perpendicularly to center of opening in oil sump.



Lift automatic transmission until bore (3) in drive plate is reached.
Carefully guide transmission into bore (3) of drive plate using Special Tool 34 2 300.
Bolt transmission case to engine.
Unscrew Special Tool 34 2 300 from tab.
Repeat torque converter
Tightening torque*



Pour in ATF

version with Oil Filler Pipe:
Pull or dipstick out.

Important!
Oil dipstick is locked and can only be pulled out after lifting it on the grip.



Pour in ATF only with use of Special Tool 34 0 380.
Volume approx. 3.0 liters

* Refer to Specifications



L
H

24-0/308

Check: correct oil level with selector lever in P or Hand engine running at idling speed.
Car must be on a level surface.
Wipe off oil dipstick with a rag which does not lose lint.
ATF temperature is sensed by a temperature dependent resistor which is integrated in the pressure switch harness.
Read ATF temperature with MiDcC or a Service Tester (refer to Test Plans).
Pull out oil dipstick and measure oil level and compare with value in this table.

Oil Temperature + C	Oil Level - H in mm min - max
30	9 - 15
40	9 - 20
50	12 - 25
60	15 - 30
70	20 - 40
80	25 - 50
90	30 - 55

Oil Level Too High
Strong foaming, loss through splashing high temperature when driving fast, oil lost via vent.

Oil Level Too Low
Valves rattling, foaming, engine spinning general operation disturbances.



Version without Oil Filter Pipe

The oil filter pipe has been omitted since 1/91.
Check ATF level after installation of the transmission.
ATF is poured in and ATF level is checked through a filler bore underneath the oil pump.

Car must be on level surface.
ATF temperature must be 30 to 55° C to check ATF level.
Interrogate ATF temperature with MiDcC or a Service Tester (refer to Test Plans).
Run engine in idling speed with selector lever in "P" or "R".
Insert oil filler plug (1).
Inspection
Check seal, replacing it if necessary.
Check oil correct ATF level.

Pour in ATF with help of filter pipe (2) as long until it runs out of the overflow hole. Screw in and tighten filler plug.
Tighten ng torque*

* Refer to Tight Tolerances
** Source of Supply (Mater Parts)

24-00-026 Removing and installing transmission

• Engine M60 • Transmission
A26 310 3

Disconnect negative lead from battery
Caution!

Disconnecting the negative lead cancels the fault memories in the control units.

For this reason, first interrogate the fault memories with the Service Tester and print out any faults recorded.

Remove complete underbody protection.

Remove complete exhaust assembly 18-00-000

Remove and cover



Heat shield (1)

Remove bracket for Lambda oxygen sensor plug.



31-0/00 1

Unzip cable bracket on transmission.



31-0/00 4

Loosen nut (1).



31-0/00 5

Caution!
To prevent deformation of the cable, always brake the screw with special tool 24-5-220.
Tightening torque:

None

Special tool 24-5-220 can only be fitted in setting "P".



31-0/00 6

Remove Bowden cable sleeve from coupler support.
Pull out cable.

Installation instruction:
Fit rubber gasket.
Tightening torque:

Adjust selector lever, see 24-00-007



Turn layonnet lock (1) counterclockwise.
Pull off plug (2).
Lift out harness out of holder.

Installation:
Connect plug (2) that marks (3) are aligned.



Pull oil cooler pipe out of transmission.

Installation:
Check O-rings (2), replacing them if necessary.



Unscrew oil cooler pipe clamps on power steering pump.

Installation:
Tightening torque*



Unscrew adjuster at left and right hand ends and let it hang down.



Unscrew oil cooler pipe clamps on oil pump.

Installation:
Tightening torque*

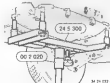


Assemble Special Tool 24 5 300 to suit a 5 HP-10 transmission.



Unscrew oil cooler pipe clamp (1).

Installation:
Tightening torque*



Support transmission from underneath using Special Tools 24 5 300 and 80 2 020.

* Refer to Specifications



Unscrew cross member

Installation
Center transmission - refer to Group 26.
Tightening torque*



Unscrew exhaust suspension at transaxle side



Unscrew joint disc at transmission



Installation
Replace shop nuts
Tighten bolts to specified tightening torque*

Important
Only turn nuts on flange and whenever possible by design to avoid breaking in the joint disc

* Refer to Specifications

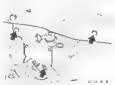


Unscrew center mount
Bend propeller shaft down and pull left of centering pins on transmission

Important!
Do not let propeller shaft fall into joints
Suspend it from car on piece of wire



Installation
Preload center mount in forward direction by distance (A) = 2 - 4 mm.
Tightening torque*



Unscrew rear axles at left and right hand sides and push forward



Tight steering wheel fully against left or right lock

Lift flap out of opening in oil pump

* Refer to Specifications



Unscrew torque converter from drive plate with special tool 24 1 110.
(3 or 4 screws).
To do this, turn flywheel round one screw at a time.

The torque converter screw connection has been changed from 3 to 4 screws.



Installation instruction
Note that Torx screws are fitted with washers "tightening torque" -



Fit special tool 11 2 480 between connecting tube and engine oil pump.



Secure torque converter to prevent it from falling out. To do this, place special tool 24 4 080 on transmission case with flat side of retaining tongue (1) against torque converter and secure.
Pull transmission off of engine.

Caution!
To transport the transmission, lower transmission fully onto lifting fixture.
Risk of accident.



Note dowel sleeves.
If necessary, transfer / replace dowel sleeves on transmission.



Installation instruction
Turn the torque converter on the transmission until here (1) faces down perpendicular to the []
Screw special tool 24 2 300 into the hub.



Lower transmission.

Caution!
The exhaust manifold must not contact the section about intake.



Unscrew transmission on engine
(Torx screws)

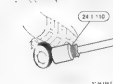
Note
Screws (1) Torx E 10
all others Torx E 12
The screws opposite the starter motor (2) have nuts on the front.



Installation
Bore (3) or drive plate must point perpendicularly to center of opening in oil pump



Installation
Lift automatic transmission until bore (3) in drive plate is reached.
Carefully guide transmission into bore (3) of drive plate using Special Tool 24 2 300.
Bolt transmission case to engine.
Unscrew Special Tool 24 2 300 from tab forward.
Mount torque converter to flywheel.
Tightening torque*



Installation
Install bolt using Special Tool 24 1 110 and tighten using a torque wrench.
Tightening torque*

Important!
Only use original bolts** together with spring washers.
Non-conformance will lead to destruction of the transmission.



Installation
Fill transmission with ATF

ATF is poured in through filter opening underneath the oil pump.
Unscrew filter plug (3).
(Check seal, replacing it if necessary.)



Car must be on level surface.
With engine stopped, pour in ATF with help of filler neck (3)** as long until it runs out of the overflow hole.
Do not plug hole.
Start engine and shift in and out of all gears several times while operating the brake pedal.

ATF temperature must be 30 to 55° C.

Interrogate ATF temperature with MoDCC or a Service Tester (refer to Test Plans).
Run engine at idling speed with selector lever in "P" or "N".
Recheck ATF level.
Spline in 0.5m plug.
Tightening torque**

* Refer to Specifications.
** Source of Supply: BMW Parts

* Refer to Specifications.
** Source of Supply: BMW Parts

24-00 028 Removing and installing transmission with transfer case - 4-wheel drive

Disconnect negative lead.

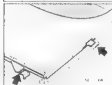
Caution!

First read fault memories with tester and print any faults since disconnecting the negative lead will cancel the fault memories in the control units. Removing and installing exhaust assembly 18 00 000



a Remove fan shroud

Remove expanding rivets from fan shroud and lift fan shroud up slightly



Installation instruction

Connect up fan shroud on left and right and in center



c Remove propeller

Remove head ball pin plate (1).



Unscrew propeller shaft on transmission

Installation instruction

Replace stop nuts

Tightening torque 26 N 11 342*



Unscrew center mount

Installation instruction

Press center mount in direction of travel
A ± 2 - 4 mm



Push propeller shaft downwards and withdraw from transmission

Caution!

Do not allow the propeller shaft to drop into the joints

Support propeller shaft from car on a piece of wire

Tightening torque 26 N 11 342*



24-00 028

Working on the automatic transmission

Remove bracket.

Remove Bowden cable

* Refer to Specifications

Unscrew nut for Bowden cable sleeve



Detach Bowden cable sleeve from bracket



Fig. 1-1-1

Preassemble special tools 27 1 031 and 27 1 033 (to suit automatic transmission)

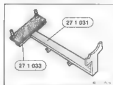


Fig. 1-1-2

Support transmission on lifting fixture 00 2 030

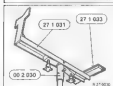


Fig. 27-0030

Unscrew cross-member from body and transfer bar and remove

Lower transmission

Installation instruction
tightening torque 24 71 142*



Fig. 1-1-3

Adjust inclination by turning the knurled-head bolts with special tool 27 1 034

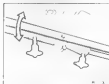


Fig. 1-1-4

Jam a block (wooden or similar material) between front sub-carrier and engine oil pan (A = 50 mm).



Fig. 1-1-5

The block prevents the engine from tipping forwards when the transmission flange is unfast.

In addition, instruction:
When emptying the transmission, the coolant air guide for the alternator can slip out.
Check once the transmission has been in-



Fig. 27-0030

* Refer to Specifications



Disconnect plug connection for transmission control unit (beyond connection)



Turn beyond connection for transfer box control counter clockwise and remove

Installation instruction:
Fit plug in such a way that marking grooves are aligned with one another



Remove bracket for cable on transmission control unit



Loosen oil cooler pipe clamps on crankcase and oil pan

Installation instruction:
Tightening torque 17-22 34,5°

* Refer to Specifications



Remove retaining tab (1) for oil cooler lead on transmission.
Withdraw oil cooler lead



Installation instruction:
Check O-rings (2), replacing if necessary



Lift rubber stops out of aperture in cover plate (below exhaust manifold)

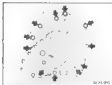


Loosen the screw connections on the torque converter using torque tool 24 1 110.
To do this, keep rotating engine as far as next screw by turning the central screw on the crankshaft

Caution:
Only use original bolts

Installation instruction:
Tightening torque 24 40 14,5°

* Refer to Specifications



Disconnect transmission range from engine (1) or 2 screws.

Installation instruction.
Note that Torx screws are fitted with washers.

Tightening torque 24 60 142*



24 60 142



Carefully remove transmission.

Caution.
Prevent torque converter from sliding out.
To do this, press down with screwdriver pointing towards transmission when removing the transmission unit.

As soon as possible, lift and secure special tool 24 4 080 on transmission case with flat side of retaining tongue (1) facing the torque converter.

Caution.
A lifting fixture with mounted transmission may be moved only in completely lowered position. The lifting fixture is not suitable for transporting the transmission.
Danger of accident! *

* Refer to Specifications



Installation instruction.
Check that dowel sleeves (1) and (2) are not missing.
If applicable, transfer dowel sleeves from transmission or use new dowel sleeves.



Version with sheet metal flange

Caution!
Keep to sequence of installation.
Sheet metal flange (2) has three indentations for the torque converter mounting tabs.

When guiding the engine and transmission together the three mounting tabs on the torque converter must be aligned with the three indentations in the sheet metal flange. Mis-alignment will lead to secondary damage on the automatic transmission.
Turning the torque converter, or cranking the engine, is no longer possible after guiding the engine and transmission together and would lead to damage.



As soon as possible, lift and secure special tool 24 4 080 on transmission case with flat side of retaining tongue (1) facing the torque converter.

Caution.
A lifting fixture with mounted transmission may be moved only in completely lowered position. The lifting fixture is not suitable for transporting the transmission.
Danger of accident! *

* Refer to Specifications



Note: On drive shaft must point perpendicularly to center of opening in guard.

* Refer to Specifications



Turn torque converter on the transmission that bones in the tabs point to the center of bones in the flywheel

Screw special tool 24 2 300 into the tabs

Lift Automatic Transm. section until bones in drive plate is reached
Guide transmission in carefully with special tool 24 2 300 in bones (3) on the drive plate
Bolt transmission case to engine
Unscrew special tool 24 2 300 from the tabs to wards the front
Mount torque converter
Tightening torque 24 40 1 A/2



a Check transmission fluid level.

The ATF fluid¹⁾ is filled through the lower filler aperture in the oil pan.
Remove filler plug (2).

Installation continuation
Check seal, replacing if necessary

Car must be standing on a level surface.
When the engine is stationary, top up with ATF fluid with filler neck (2)²⁾ until fluid over flows around the filler screw.
Don't plug the hole.
Start engine. Depress brake and shift the selector lever through all positions several times.

Oil temperature must be between 30 °C/86 °F

Interrogate with Metric or Service Tester (see Troubleshooting Manual)
Allow engine to idle in selector setting 'P' or 'N'.
Recheck ATF level.
Screw in filler plug.
Tightening torque³⁾

¹⁾ Refer to Specifications

²⁾ Refer to Specifications
³⁾ Source of Supply: BMW Parts Service
⁴⁾ Refer to Consumption Specifications



30 24 004 0

24 00 046 Installing exchange transmission

Removing transmission 24 00 026

Caution!

Always clean oil cooler and pipes with compressed air and flush twice with ATF before installing an exchange transmission.
Transmission identification coding* on type plate or label

Perform an oil level check
(Refer to 00 11 238).



30 24 027 0

Transfer transport holder (1)



30 24 028 0

Transfer lever (2) and retaining bracket (3) and cable bracket for Lambda oxygen sensors.

Installation and friction

Tightening torque 24 51 14.2*



30 24 029 0

Caution!

Automatic transmissions are supplied filled with ATF.
Work on with oil filler pipe.
Remove plug 1 from oil pump before installing the oil filler pipe.
Catch escaping ATF in a clean container.
Pour in ATF using special tool 24 0 080 after installing transmission.

* Refer to Specifications



24 11 006 REMOVING AND INSTALLING SEALING TRANSMISSION OIL PUMP

Drain oil.

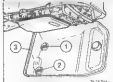
Insertion with Oil Filter Pipe
Unscrew filter pipe (7).



Unscrew oil pump.
Take off oil pump with gasket.



Positioning
Mount holder with straight arm on side and curved holders at front and rear.
Tightening torque



Clean oil pump.

Important!
Place magnets (1) and (2) in oil pump.
Check gasket (3), replacing if necessary.

Refer to Specifications



Version with Oil Filter Pipe
Pull out oil dipstick.

Important!
Oil dipstick is locked and can be pulled out only after lifting the handle four in 10".



Pour in ATF using Special Tool 24 0 080.
Volume of ATF: approx. 1.0 liters.

Check: correct oil level with selector lever in P or R and engine running at idling speed.

Oil level: be on a level surface.

Wipe off oil dipstick with a rag which does not leave dirt.

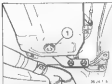
ATF temperature is sensed by a temperature dependent resistor which is integrated in the transmission with harness.

Read ATF temperature with MoDAC or a Service Tester (prior to Test Plan).

Pull out oil dipstick and measure oil level and compare with value in the table.



Oil Temperature ° C	Oil Level = in or mm	
	Min.	Max.
30	3	18
40	4	23
50	12	31
60	18	38
70	21	48
80	26	53
90	31	58



Version without Oil Filler Pipe
Oil filler pipe is omitted on all 1.9i
Automatic transmissions are filled with
ATF through filler opening from below on
the oil pump.
Unscrew filler plug (1).

Installation
Check level, replacing if necessary.



Car must be on a level surface.
With the engine stopped, pour in ATF
using filler (2) as long until ATF runs out
of overflow hole.
Do not plug the hole.
Start engine and move selector lever in
and out of all positions, while operating the
brake pedal.
ATF temperature must be 30 - 55 °C.
Interrogate ATF temperature with MoDc or
Service Tester (refer to Test Plan).
Run engine at idling speed with selector
lever in R or N.
Recheck ATF level.
Screw in and tighten filler (1)†
† Tightening torque*

* Refer to Specifications
† Source of Supply: BMW Parts

24 12 016 Replacing radial oil seal for output flange

Remove prop shaft (refer to 24 00 008)
The output flange can no longer be dismantled from outside
Transmission extension has to be removed for removal of output flange

Caution!
Until this design modification is introduced, the oil pan must be removed before removal of the transmission extension and special tool 24 1 210 must be used, otherwise the clutch disks will slip out.

Removal of this 1 is necessary to dismantle the transmission

Special tool need no longer be used for removal of the oil pan with effect from

Transmission number: 112500

For installation of special tool 24 1 210:

To remove oil pan, refer to 24 11 008
Remove cover plate (1) from shift unit

Installation instruction
Tightening torque 24 11 242*

* Refer to Specifications



Prevent axial movement by inserting special tool 24 1 210 between parking pawl gear and case.
Plate could slide out during removal of the transmission extension.
Unscrew bolt on main body.
Install special tool 24 1 210 for parking pawl detent and case and secure with screw (1).

Both versions:

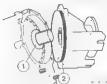
Remove cross member from body and transmission extension
Unscrew bolts

Installation instruction
Install guide (1) for cable holder
Tightening torque 24 11 142*

Pull off transmission extension
Watch out for spacer (1)
Replace O-ring (2)

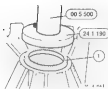
Drive shaft retaining tab on grooved rail

* Refer to Specifications





Clamp Rod at Tool 24 1 220 in a vice.
Place transmission extension with output flange in Special Tool 24 1 220.



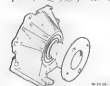
INSTALLATION

Drive in new radial oil seal (1) flush using Special Tools 24 1 190 and 00 5 500.



Unscrew slotted nut (7) using Special Tool 24 1 170.

Use caution
"tightening torque"



Take transmission extension (1) off Special Tool 24 1 220.
Pull output flange out of bearings.



1. Lift out radial oil seal (1).

* Refer to Specifications



24 12 106 Replacing radial oil seal for manual shift valve shaft

Locate seal (1)

Caution:

In order to avoid deforming the operating cable, clamping device must be held with special tool 24 5 230.

Note:

Special tool 24 5 230 can only be fitted in position "P".

Detach operating cable from support bracket. Pull out operating (Bowden) cable.

Installation note:
Adjust gearshift,
refer to 24 00 007



Fit special tool 24 5 490 on manual shift valve shaft.

Oil sealing lip of new radial oil seal (1) with automatic transmission oil.

Slide on radial oil seal (1) up to casing.



Installation note:

Press radial oil seal into transmission casing with special tool 24 5 250.

Remove special tool 24 5 490 from manual shift valve shaft.



Remove lower (2)

Installation note:

For tightening torque 24 51 142*



Remove radial oil seal from transmission casing with special tool 24 5 260.

* Refer to Technical Data



M 12 135

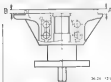
24 12 155 REPLACING OUTPUT FLANGE

Remove output flange - refer to 24 12 018

Important!

Axial play must be checked and, if necessary, adjusted.

Clamp transmission extension in a vice
Output flange must not bear
Press output flange in direction of output



M 24 131

Measure distance (A) from shoulder to seating surface and distance (B) from shoulder to end of output flange

Example:

- A = 10.5 mm
- B = 7.4 mm
- C = 3.8 mm

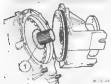


M 24 134

Measure distance (E) from seating surface to shoulder (1) on parking lock gear
Press in parking lock gear for this purpose

Example:

- E = 4.0 mm



M 12 135

Example:

- E = 4.0 mm
- C = 3.8 mm
- 3.4 mm
- = 0.18 - 0.35 mm axial play

Install spacer (1) of correct thickness.
Spacers are available from Parts in thicknesses of 0.8 to 2.8 mm.



M 12 134

24 12 708 REPLACING BEARING OF TRANSMISSION EXTENSION - Output Flange Removed -

Unscrew circlip (1).
Remove ball ring (2).



M 24 131

Heat transmission extension in area of bearing race to about 80 °C with a hot air blower.
Remove bearing race (3).

Important!

First insert ball ring (4) before installing bearing race.

Important!

Axial play must be checked and, if necessary, adjusted - see 24 12 155.



24 30 008 REMOVING AND INSTALLING OR REPLACING VALVE BODY

Remove oil pump - see 24 11 008
Remove oil strainer - see 24 30 155
Unhook cover (1) from valve body

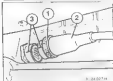
Installation
Tightening torque*



Insert the valve body in case

Important!
Only unscrew bolts with head size (A) of 12 mm

Installation
Tightening torque*



Turn bypass lock (1) counterclockwise
Pull off plug (2)

Installation
Connect plug (2) that marks (3) are aligned



Unscrew nut (2)

Installation
Tightening torque*

* Refer to Specifications



Pull out plug

Installation
Check O-ring (1), replacing if necessary
Install the flat side on plug faces case

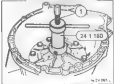


Installation
Hold plug receptacle on the flat side with a screwdriver to prevent turning.



Remove valve body with wire harness.

Installation
Attach valve body to centering pin (1) and
insert valve (2) in selector lever shaft (3)



24 31 000 REMOVING AND INSTALLING SEALING OIL PUMP HOUSING

Remove torque converter. See 24 40 000.
Mount transmission on Special Tool 24-D-150 in conjunction with Special Tool 00-1-490.
Mount transmission in horizontal position with help of Special Tool 24-D-151.

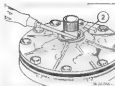
Set transmission upright.
Mark installed position of oil pump housing to make reinstallation easier.

Use new bolts.

Important!
Watch out for seals (1).

Installation
Replace seals (1).

Apply Special Tool 24-D-180 and clamp right on converter support when the oil pump housing is pressed out by turning spindle (1) in.
Lift out oil pump housing.
Remove Special Tool 24-D-180.

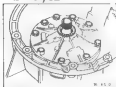


Lift out radial oil seal (2).

Lubricate sealing lip of radial oil seal with ATF.
Drive in radial oil seal (2) to fit tight using Special Press 24-D-110 and 24-D-111.
Installed depth ± 1 mm.

Replace round seal (3).

Check for correct installed position of thrust washer (4), needle bearing (5) and thrust washer (6) before installing the oil pump housing.
Lubricate round seal (3) with ATF.

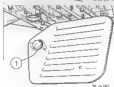


Mount oil pump housing.
Check seal-made marks.
Install bolts with new seals.
Bolt oil pump housing to transmission case
by tightening the bolts uniformly.
Tightening torque = 10 Nm.



24-31-100 REMOVING AND INSTALLING OR REPLACING TRANSMISSION OIL STRAINER

Remove oil pump - see 24-31-008.
Unscrew oil strainer on valve body



Watch out for O-ring (1).

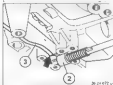
Installation
Tightening torque = 5 Nm



24 34 008 REMOVING AND INSTALLING OR REPLACING PARKING LOCK (PAWL, SPRING)

Remove valve body - see 24 36 008
Unscrew holder (1) on case.

Installation
Tightening torque*



Take off holder

Installation
Connecting rod (1) must engage in groove of locking lever (2).



Unscrew plug (4).

Installation
Check seal (3), replacing if necessary
Tightening torque*



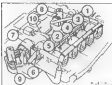
Drive out shaft pin from inside to outside



Remove spring (1) and parking lock lever (2).

Installation
Install spring (1) that long arm faces lock
ing lever (2).

* See Specifications



Arrangement of Solenoid Valves

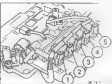
- 1 Solenoid valve
- 2 Solenoid valve
- 3 Solenoid valve
- 4 Solenoid valve
- 5 Solenoid valve
- 6 Solenoid valve for some lock-up clutch
- 7 Pressure regulator
- 8 Pulse sender for mean turbine speed
- 9 Pulse sender for output speed
- 10 Temperature sensor



Installation
Install holder (10) with curved side facing solenoid valve.
Tightening torque*

Pull out solenoid valve.

Identification
Solenoid valves are identical.

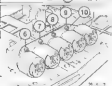


24-34-352 REPLACING ALL SOLENOID VALVES

Remove valve body - 24-30-005.
Pull plugs (1 - 5) off of solenoid valves.
Do not pull on wires.



Remove solenoid valve (8).
Pull off plugs (1 and 2) and unscrew screws (3).



Unscrew screws (8 - 10).
Take off holder (10).



Take off holder (4).
Pull out solenoid valve.

Installation
Install holder (4) with lightly curved side facing valve housing.
Identification: solenoid valve (8) has a white plug receptacle.
Tightening torque*

* Refer to Specifications



24-34 861 REPLACING PRESSURE REGULATOR FOR VALVE BODY

Remove valve body - see 24-30 006.
Pressure regulator (7) cannot be replaced separately, since the modulation pressure has to be adjusted. Modulation pressure can only be adjusted by the manufacturer.

Replace pressure regulator (7) only in conjunction with valve housing (1).

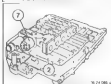


Remove solenoid valves (1, 4) - see 24-30 006.

Unscrew valve housing on valve body by loosening screws (2, 13).

Important!
Check length of screws

Installation
Tightening torque*



Take valve housing (2) with pressure regulator (7) off of valve body.

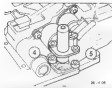


24-34 871 REPLACING PULSE SENDER FOR OUTPUT SPEED

Remove valve body - see 24-30 006.
Pull off plug (4).

Unscrew screws (2 and 3).

Installation
Tightening torque*



Lift off pulse sender

Important!
Watch out for spacers (4 and 5).



24-34 873 REPLACING PULSE SENDER FOR TURNING SPEED

Remove valve body - see 24-30 006.
Pull off plug (4).
Unscrew screws (2 and 3).
Lift off pulse sender

Installation
Tightening torque*

* See Specifications

* See Specifications



Fig. 2-12 10-1

24-35 801 REPLACING WIRE HARNESS IN AUTOMATIC TRANSMISSION

Remove valve body - see 24-35 005.

Pull plugs off of solenoids (1 - 6) and

pressure regulator (7).

Pull plugs (8 and 9) off of pulse senders.

Note:

Temperature sensor (10) is integrated in the wire harness and must be inserted into holder (11).

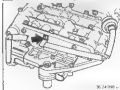
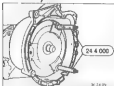


Fig. 2-12 10-2

Unscrew holder on valve body.

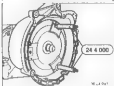
Take off wire harness.



30 24 000



30 24 000 1



30 24 000 1

24 40 000 REMOVING AND INSTALLING OR REPLACING TORQUE CONVERTER

Remove transmission - see 24 00 000
Pull torque converter out of primary pump carefully using Special Tools 24 4 000.

Caution!
Escaping ATF

Torque converters cannot be cleaned with common workshop equipment and must be replaced when damaged.
Torque converter identification*

Caution! guide openings on converter into primary pump by turning slightly and using Special Tool 24 4 000.

Important!
Make sure that converter bearing and seal are not damaged while guiding in.
Install torque converter as far as stop.



24 24 310 REMOVING AND INSTALLING REPLACING CONTROL UNIT

The control unit for SH transmissions is located in the right A-pillar.
Reset and print fault memories prior to removal.
Remove gearbox - refer to 24 10 340
Unscrew loudspeaker cover.
Disconnect loudspeaker wires.
Remove protective hood.



Pull plug (1) off of the control unit after unhooking spring retainer (2) downwards.

Caution

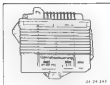
Always switch the ignition off before disconnecting or connecting the plug.



Pull soundproofing sheet off partially.
Only loosen screws (3 - 5).



Lift control unit out and remove downwards.



Code is provided on the data plate.
Refer to BMW Parts Catalog for cross-reference of types and models.

TROUBLESHOOTING AUTOMATIC TRANSMISSION A 5 S 310 Z

Condition	Cause	Correction
Problem		
Park position does not engage	a) Shift linkage between selector lever and transmission misadjusted b) Excessive friction in parking lock mechanism	a) Adjust shift - see 24 00 008 b) Replace parking lock parts (connecting rod, pin) - see 24 24 008
Park position does not hold (slips)	a) Shift linkage between selector lever and transmission misadjusted	a) Adjust shift - see 24 00 008
Engine cannot be started in R or P, or can be started in all positions	a) Shift linkage between selector lever and transmission misadjusted b) Transmission switch faulty Starter interlocking relay or wire faulty	a) Adjust shift - see 24 00 008 b) Replace transmission switch - see 25 16 000 Repair/replace relay or wire
Position R	a) Shift linkage between selector lever and transmission misadjusted	a) Adjust shift - see 24 00 008
No reverse gear	a) Clutch B destroyed b) Brake D destroyed. In this case also no engine braking effect in position 2, 1st gear c) Brake G destroyed	b) Exchange transmission - see 24 00 046 c) Exchange transmission - see 24 00 046 d) Exchange transmission - see 24 00 046
	e) Refer to "Troubleshooting Valve Body"	
Hard engaging (on P-R) or R-R	a) Idling speed too high b) Refer to "Troubleshooting Valve Body"	a) Refer to "Idle Plan"
Backup Lights do not light up (Electrics OK)	a) Transmission switch faulty b) Shift linkage between selector lever and transmission misadjusted	a) Replace transmission switch - see 25 16 000 a) Adjust shift - see 24 00 008
Car rejects or engages	a) Shift linkage between selector lever and transmission misadjusted b) Clutch A defective (bonded)	a) Adjust shift - see 24 00 008 b) Exchange transmission - see 24 00 046

Condition	Cause	Correction
Position D	a) Clutch A destroyed	a) Exchange transmission - see 24 00 046
No power flow	b) 1st gear one-way clutch faulty	b) Exchange transmission - see 24 00 046
	c) Shift linkage between selector lever and transmission misadjusted	a) Adjust shift - see 24 00 008
Hard engaging (at H - D engine speed > 1500 rpm)	a) idling speed too high	a) Refer to "Test Plan"
	b) Also refer to "Troubleshooting Valve Body"	
No shift (warm or cold)	a) Refer to "Troubleshooting Valve Body"	
Shift 1-2	a) Brake C1 and 2 faulty	a) Exchange transmission - see 24 00 046
	b) Insufficient oil supply to brakes C1 and C2	b) Exchange transmission - see 24 00 046
Shift 2-1	a) Refer to "Troubleshooting Valve Body"	
Shift 2-3	a) Clutch F faulty	a) Exchange transmission - see 24 00 046
	b) Insufficient oil supply to clutch F	b) Exchange transmission - see 24 00 046
Shift 3-1	a) Refer to "Troubleshooting Valve Body"	
Shift 3-4	a) Clutch E faulty	a) Exchange transmission - see 24 00 046
	b) Insufficient oil supply to clutch E	b) Exchange transmission - see 24 00 046
No braking effect Shift 4-3	a) Brake band C2 faulty in this case shift 1-2 not OK	a) Exchange transmission - see 24 00 046
	b) Insufficient oil supply to brake C2	b) Exchange transmission - see 24 00 046
	c) Brake band C2 not preloaded, spring broken, in this case shift 1-2 not OK	c) Adjust brake band

Condition	Cause	Correction
Shift 4-5	a) Refer to "Troubleshooting Valve Body"	
Shift 5-4	a) Clutch A faulty, in this case no 1st - 4th gears	a) Exchange transmission - see 24 00 046
Shift from full road to a slowdown too long	a) Plates broken b) Also refer to "Troubleshooting Valve Body"	a) Exchange transmission - see 24 00 046
Engine spins in shift 2-3	a) Poor friction torque at plates b) 1st gear one-way clutch not OK	a) Exchange transmission - see 24 00 046 b) Exchange transmission - see 24 00 046
Engine spins in shift 3-3-2	a) Poor friction torque at plates b) Also refer to "Troubleshooting Valve Body"	a) Exchange transmission - see 24 00 046
Engine spins in shift 4-3	a) Poor friction torque at plates b) 3rd gear one-way clutch not OK	a) Exchange transmission - see 24 00 046 b) Exchange transmission - see 24 00 046
Engine spins in shift 4-3-4	a) Poor friction torque at plates b) Also refer to "Troubleshooting Valve Body"	a) Exchange transmission - see 24 00 046
No engine braking effect, no manual detent 3-4	a) Clutch A damaged b) Also refer to "Troubleshooting Valve Body"	a) Exchange transmission - see 24 00 046
4-3 - 3-2	a) Refer to "Troubleshooting Valve Body"	a) Exchange transmission - see 24 00 046
No 1st gear, no braking effect	a) Brake D faulty b) Also refer to "Troubleshooting Valve Body"	a) Exchange transmission - see 24 00 046

Condition	Cause	Correction
Shift initiation too hard	a) Torque converter faulty b) Also refer to "Troubleshooting Valve Body"	a) Replace converter - see 24 40 008
No converter lockup clutch	a) Torque converter faulty b) Also refer to "Troubleshooting Valve Body"	a) Replace converter - see 24 40 008
Engine dies when moving off in Drive (converter lockup clutch always engaged)	a) Torque converter faulty b) Also refer to "Troubleshooting Valve Body"	a) Replace converter - see 24 40 008
Noise	a) ATF level too low b) Valve body leaks c) Oil strainer dirty d) Round seal on oil filter missing - faulty	a) Correct ATF level - see 24 30 026 b) Exchange valve body - see 24 30 008 c) Replace oil strainer - see 24 31 156 d) Replace seal - see 24 31 136
Leakage	a) Seals on oil pump body leak b) Round seal on oil pump body leaks c) Radial oil seal for torque converter faulty	a) Replace seals - see 24 31 022 b) Replace round seal - see 24 31 029 c) Replace radial oil seal - see 24 31 025
Leak between transmission case and oil sump	a) Mounting bolts loose b) Gasket faulty	a) Tighten bolts* b) Replace gasket - see 24 11 008

* Refer to Specifications for tightening torque

Condition	Cause	Correction
Leaks	a) Radial oil seal for output flange leaks	a) Replace radial oil seal - see 24 12 016
Output leaks	b) O-ring for transmission extension leaks	b) Replace O-ring - see 24 12 016
Manual shift valve shaft leaks	a) Radial oil seal leaks	a) Replace radial oil seal - see 24 12 106
Transmission plug leaks	a) Nut loose	a) Tighten nut*
	b) O-ring faulty	b) Replace O-ring
Plugs on transmission case leak	a) Plugs loose	a) Tighten plugs*
	b) Seals faulty	b) Replace seals
Oil cooler pipes leak	a) Oil cooler pipes loose	a) Tighten oil cooler pipes*
	b) O-rings faulty	b) Replace O-rings

* Refer to Specifications for tightening torque

TROUBLESHOOTING VALVE BODY A 5 S 310 Z

Symptom	Cause	Remedy
Position R	a) Signal wire to solenoid 3 grounded	a) Repair/replace wire harness - see 24 35 501
No power flow in reverse	b) Valve piston for reverse gear lock not in parked position	b) Exchange valve body - see 24 30 006
Hard engaging jolt in position R	a) Damper of brake B malfunctions	a) Exchange valve body - see 24 30 006
	b) Modulation pressure too high	b) Replace pressure regulator - see 24 34 861
	c) Wire to pressure regulator faulty	c) Repair/replace wire harness - see 24 35 501
	d) Pressure regulator faulty	d) Replace pressure regulator - see 24 34 861
	a) Damper A blocked	a) Exchange valve body - see 24 30 006
No power flow in forward	b) Signal wire to solenoid 3 grounded	b) Repair/replace wire harness - see 24 35 501
Hard engaging jolt in position D	a) Damper of clutch A malfunctions	a) Exchange valve body - see 24 30 006
	b) Wire to pressure regulator faulty	b) Repair/replace wire harness - see 24 35 501
	c) Pressure regulator faulty	c) Replace pressure regulator - see 24 34 861
	a) Modulation valve malfunctions	d) Exchange valve body - see 24 30 006
Hard shift jolts in general	a) Modulation valve malfunctions	a) Exchange valve body - see 24 30 006
	b) Wire to pressure regulator faulty	b) Repair/replace wire harness - see 24 34 501
	c) Pressure regulator faulty	c) Replace pressure regulator - see 24 34 861

Condition	Diagnosis	Correction
Position 0		
No shift 1-2	<ul style="list-style-type: none"> a) Wire to output speed sensor faulty b) Output speed sensor faulty c) Signal wire to solenoid 1 grounded d) Shift valve 1 seized in parked position e) Damper C2 or clutch valve C1 seized f) Shift valve 3 seized in parked position 	<ul style="list-style-type: none"> a) Repair/replace wire harness - see 24 30 001 b) Replace speed sensor - see 24 34 871 c) Repair/replace wire harness - see 24 30 001 d) Exchange valve body - see 24 30 000 e) Exchange valve body - see 24 30 000 f) Exchange valve body - see 24 30 000
No shift 2-1	<ul style="list-style-type: none"> a) Signal or positive wire to solenoid 1 faulty b) Solenoid 1 faulty c) Shift valve seized in pushed position 	<ul style="list-style-type: none"> a) Repair/replace wire harness - see 24 30 001 b) Replace solenoid 1 - see 24 34 883 c) Exchange valve body - see 24 30 000
No shift 2-3	<ul style="list-style-type: none"> a) Signal wire to solenoid 2 faulty b) Solenoid 2 faulty c) Shift valve 2 seized in pushed position d) Pulling valve 2-3 seized in parked position 	<ul style="list-style-type: none"> a) Repair/replace wire harness - see 24 30 001 b) Replace solenoid 2 - see 24 34 883 c) Exchange valve body - see 24 30 000 d) Exchange valve body - see 24 30 000
No shift 3-2	<ul style="list-style-type: none"> a) Signal or positive wire to solenoid 2 faulty b) Shift valve seized in parked position c) Pulling valve 2-3 seized in pushed position 	<ul style="list-style-type: none"> a) Repair/replace wire harness - see 24 30 001 b) Exchange valve body - see 24 30 000 c) Exchange valve body - see 24 30 000

Condition	Cause	Correction
Position D	a) Signal wire to solenoid 3 grounded	a) Repair/replace wire/harness - see 24 38 001
No shift 3-4	b) Solenoid 3 faulty	b) Replace solenoid 3 - see 24 34 053
	c) Shift valve seized in pushed position	c) Exchange valve body - see 24 30 006
	d) Damper E seized	d) Exchange valve body - see 24 30 006
No shift 4-5	a) Signal or positive wire to solenoid 3 faulty	a) Repair/replace wire/harness - see 24 38 001
	b) Shift valve 3 seized in parked position	b) Exchange valve body - see 24 30 006
No shift 4-5	a) Signal or positive wire to solenoid 1 faulty	a) Repair/replace wire/harness - see 24 38 001
	b) Shift valve 4 seized in parked position	b) Exchange valve body - see 24 30 006
	c) Damper C2 seized	c) Exchange valve body - see 24 30 006
No shift 5-6	a) Signal wire to solenoid 1 grounded	a) Repair/replace wire/harness - see 24 38 001
	b) Solenoid 1 faulty	b) Replace solenoid 1 - see 24 34 053
	c) Shift valve 4 seized in pushed position	c) Exchange valve body - see 24 30 006

Condition	Cause	Correction
Car moves off in 2nd gear	a) Signal or positive wire to solenoid 1 faulty. in this case no 5th gear	a) Repair/replace wire harness - see 24 35 501
	b) Shift valve 1 seized in parked position	b) Exchange valve body - see 24 35 005
Car moves off in 3rd gear	a) Signal or positive wire to solenoids 1 and 2 faulty	a) Repair/replace wire harness - see 24 35 501
	b) Shift valves 1 and 2 seized in parked position	b) Exchange valve body - see 24 35 005
Car moves off in 4th gear	a) General positive wire faulty (transmission without current)	a) Repair/replace wire harness - see 24 35 501
	b) Shift valves 1, 2 and 3 seized in parked position	b) Exchange valve body - see 24 35 005
Shift transitions in zero load positions Full load shifts too hard	a) Modulation valve malfunctions	a) Exchange valve body - see 24 35 005
	b) Wire to pressure regulator faulty	b) Repair/replace wire harness - see 24 35 501
	c) Pressure regulator faulty	c) Replace pressure regulator - see 24 34 541
	d) Damper malfunctions	d) Exchange valve body - see 24 35 005
Shift transitions at full load and kick-down shifts too long	a) Pressure reducing valve 1 or 2 malfunctions	a) Exchange valve body - see 24 35 005
	b) Modulation valve malfunctions	b) Exchange valve body - see 24 35 005
	c) Pressure regulator faulty	c) Replace pressure regulator - see 24 34 541

Condition	Reason	Correction
Engine dies from shift 3-3 / 3-2 (overlapped control)	<ul style="list-style-type: none"> a) Signal or positive wire to solenoid 4 faulty b) Solenoid 4 faulty c) Pull/push valve 1 moves too hard d) Aperture for damper G clogged e) Damper F moves too hard f) Pull valve 3-3/3-2 moves too hard 	<ul style="list-style-type: none"> a) Repair/replace wire harness - see 24.36.501 b) Replace solenoid 4 - see 24.34.853 c) Exchange valve body - see 24.30.006 d) Exchange valve body - see 24.30.006 e) Exchange valve body - see 24.30.006 f) Exchange valve body - see 24.30.006
Engine dies from shift 4-3 / 3-3 (overlapped control)	<ul style="list-style-type: none"> a) Signal or positive wire to solenoid 5 faulty b) Solenoid 5 faulty c) Pull/push valve 2 moves too hard d) Damper C2 malfunctions e) Pull valve 4-3/3-3 moves too hard f) Damper A moves too hard 	<ul style="list-style-type: none"> a) Repair/replace wire harness - see 24.36.501 b) Replace solenoid 4 - see 24.34.853 c) Exchange valve body - see 24.30.006 d) Exchange valve body - see 24.30.006 e) Exchange valve body - see 24.30.006 f) Exchange valve body - see 24.30.006
Converter lockup clutch Shift transition too hard	<ul style="list-style-type: none"> a) Converter lockup clutch valve malfunctions 	<ul style="list-style-type: none"> a) Exchange valve body - see 24.30.006
No converter lockup clutch	<ul style="list-style-type: none"> a) Signal or positive wire to solenoid 6 faulty b) Solenoid 6 faulty 	<ul style="list-style-type: none"> a) Repair/replace wire harness - see 24.36.501 b) Replace solenoid 6 - see 24.34.853

Condition	Cause	Correction
Engine dies when stopping car in drive position (converter lockup clutch always engaged)	a) Signal wire to solenoid B grounded b) Converter lockup clutch valve seized in pushed position c) Solenoid B faulty	a) Repair/replace wire harness - see 24-35-521 b) Exchange valve body - see 24-39-008 c) Replace solenoid B - see 24-34-853
Shift speed and shift position is general not OK	a) Temperature sensor not OK	a) Replace wire harness - see 24-35-951

TROUBLESHOOTING PERIPHERAL EQUIPMENT

Condition	Cause	Correction
Idling speed control (Pilot's valve - electronic engine power control)		
Wrong shift points, oscillating shifts	a) Engine idling speed too high or too low b) Idling speed control valve faulty	a) Refer to "Test Plan" b) Replace idling speed control valve - see 13 41 501
Kickdown switch	a) Wire harness faulty	a) Repair wire harness
No kickdown shifts - only partial load/full load shifts	b) Kickdown switch faulty c) Kickdown switch misadjusted	b) Replace kickdown switch - see 33 41 493 c) Check adjustment - see 33 41 493
Program switch		
No S program or only S program	a) Signal wire to program switch faulty b) Program switch faulty	a) Repair wire harness b) Replace program switch - see 51 31 265
No W program or only W program	a) Signal wire to program switch faulty b) Program switch faulty	a) Repair wire harness b) Replace program switch - see 51 31 265
Position switch (selector lever) No shifts Car remains in shifted gear	a) No positive supply - fuse faulty b) Signal wire faulty c) Switch faulty	a) Replace fuse b) Repair wire harness c) Replace switch - see 23 18 585

24 Automatic transmission

A55 300 J

24 00 003	Shift lever – adjust	24- 00/41
027	Automatic transmission – remove and install	24- 00/42
047	Automatic transmission – install	24- 00/48
24 11 609	Transmission oil sump – remove and install, seal or replace	24- 11/41
24 12 107	Radial oil seal for manual shift valve shaft – replace	24- 12/41
506	Radial oil seal for torque converter – replace	24- 12/42
24 20 001	O-ring for output flange – replace	24- 20/41
24 30 008	Selector unit – remove and install/replace	24- 30/41
24 31 158	Gear oil strainer – remove and install/replace	24- 31/41
24 34 140	Damper cover – remove and install/seal	24- 34/41
872	RPM sensor – replace	24- 34/42
844	Solenoid valves for pressure regulator/torque converter – replace	24- 34/43
845	Solenoid valves for reverse gear inhibit – replace	24- 34/43
846	Solenoid valve block A B C – replace	24- 34/43
24 35 006	Wiring harness for automatic transmission – replace	24- 35/41
24 40 007	Torque converter – remove and install or replace	24- 40/41
24 52 500	Notched disk – replace	24- 52/41
24 61 501	Control unit – remove and install or replace	24- 61/41
525	Resistor for control unit – replace	24- 61/42

A55 560Z

00 11 239	Oil change in automatic transmission	24- 00/51
24 00 007	Shift lever – adjust	24- 00/53
026	Automatic transmission – remove and install	24- 00/55
046	Replacement transmission – install	24- 00/60
585	Automatic transmission – disassemble and assemble	24- 00/61
24 11 008	Transmission oil sump – remove and install, seal	24- 11/50
24 12 016	Radial oil seal for output flange – replace	24- 12/50
106	Radial oil seal for manual shift valve shaft – replace	24- 12/53
506	Radial oil seal for torque converter – replace	24- 12/54
24 13 156	Output flange – replace	24- 13/50
706	Bearing for transmission extension – replace	24- 13/51
24 30 006	Selector unit – remove and install or replace	24- 30/50
24 31 156	Transmission oil strainer – remove and install, replace	24- 31/50
24 34 006	Parking lock (pawl/spring) – remove and install or replace	24- 34/50
857	Solenoid valves and/or pressure regulator – replace	24- 34/51
873	Pulse generator (turbine speed) – replace (oil pan removed)	24- 34/52
874	Pulse generator (output speed) – replace (oil pan removed)	24- 34/53
24 35 501	Wiring harness in automatic transmission – replace (selector unit removed)	24- 35/50
24 40 006	Torque converter – remove and install or replace	24- 40/50
24 61 501	(EGS) control unit – remove and install or replace	24- 61/50

Set gearshift lever (1) to "P"

Release nut (2)

Caution*

In order to avoid deforming the operating cable, the clamping screw must be held with the special tool 24 5 220.

Note

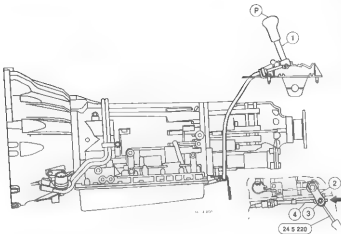
This special tool 24 5 220 can only be fitted in position "P".

Press forward lever (3) (park position).

Press operating cable rod (4) opposite forward direction and release again.

Firmly secure operating cable rod (4) with nut (2) (hold with special tool 24 5 220).

For tightening torque 24 51 162*





24 00 027 Removing and installing automatic transmission

Disconnect ground lead from battery

Caution!

Disconnecting the negative lead will cancel the fault memories in the control units. For this reason, first read fault memories with tester and print any faults prior to disconnecting battery.

Remove exhaust assembly

refer to 85 00 020

Remove fast shield (1).



Unscrew nut (1) in transmission setting "P"

Caution!

Always loose clamping screw with special tool 24 5 720 to avoid distortion of the cable.

Note

Special tool 24 5 720 can only be fitted in setting "P".

Unscrew cable from counter holder.
Pull out cable.

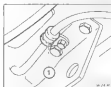
Installation:
Adjust shift mechanism, refer to 24 00 007.



Unscrew propeller shaft on transmission.

Installation:

Replace stop nuts.



Remove cable holder (2) from transmission.



Unscrew center mount.

Installation:

Preload center mount in direction of arrow (A) with 2 - 4 mm.
Fit propeller shaft downwards and withdraw from transmission.

Caution!

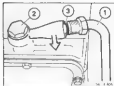
Do not allow the propeller shaft to drop into the joints.
Support propeller shaft from car on a piece of wire.



Turn beyond lock (1) counterclockwise
Pull off plug (2).

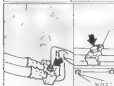
Installation:

Fit plug (2) in such a way that the marking lines (3) are aligned with one another.
Disconnect plug (4).

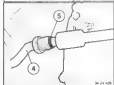


Unscrew oil cooler feed pipe (1).
Loosen coupling bolt (2) and swing component downwards.
Pull oil cooler pipe out in this position.

Installation:
Check O-ring (3), replacing it if necessary.
Tightening torque 24 31 442 *

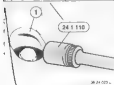


Unscrew oil cooler pipe at a tank case and oil pump.



Unscrew oil cooler return line (4).

Installation:
Check O-ring (5), replacing it if necessary.
Tightening torque 24 31 442 *



Lift cover off aperture (1) in oil pan.
Unscrew torque converter from drive plate at three points with special tool 24 1 110.
Turn flywheel for this step.



Installation:
Install tool using special tool 24 1 110 and tighten using a torque wrench.
Tightening torque 24 45 142 *

Caution:
Only use M 10 x 18 mm screws in conjunction with spring washer.



Remove stabilizer from left and right sides of engine mount.



Remove center of gravity loading.

Installation:
Once the rear crossmember has been fitted, the rubber mounts must be adapted to suit by moving them slightly.



Support transmission from below with special tool 24 5 350 in conjunction with lifting fixture 00 2 030.



Unbolt the cross member from the body.
Lower the transmission.

Attention

Center the transmission - refer to Q7 25.
Tightening torque*



Unbolt the transmission from the engine.
Unsnap the body with a 10 mm wrench
hooked.

Important!

Washers must be used to avoid increasing the braking torque.
Tightening torque*



Apply and clamp Special Tool 24 4 080 on the transmission case with the side (1) of the retainer facing the torque converter to prevent the converter from sliding out. Pull the transmission off of the engine.

Important!

The special tool jack with mounted transmission may only be moved in completely lowered position.

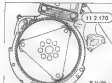


Important!

Ensure that dowel sleeves (1) and (2) are not missing prior to installation of the trans-

mission.
If necessary, transfer dowel sleeves from the transmission.

* Refer to Specifications

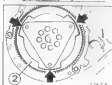


Inspection

Inspect the drive plate for cracks and checks, replacing it if necessary.
Hold flywheel with Special Tool 11 2 170.

Important!

Replace expansion bolts and install the new bolts with a bolt corrector.
Only coat the threads.
First clean the tapped holes in the crank shaft thoroughly.
Tightening torque*



Version with Sheet Metal Flywheel (2)

Important!

Keep to the sequence of installation.
Sheet metal flywheel (2) has three indentations to take the mounting tabs of the torque converter.
When guiding the engine and transmission together, the three mounting tabs on the torque converter must be aligned with the three indentations on the sheet metal flywheel.

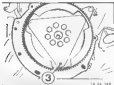
Non-conformance will cause follow-up damage to the automatic transmission.
Turning the torque converter or engine in no longer possible after guiding together and an attempt to turn equal lead to damage.



Turn the torque converter on the transmission that boom (1) of the tab points down at right angles.
Screw Special Tool 24 2 300 into the tab.

* Refer to Specifications

** Source of Supply: BMW Parts



Bore (3) of the drive plate must point at right angles to the center of the oil pan opening.



1. Lift the automatic transmission until bore (3) of the drive plate is reached.
 Guide the transmission into bore (3) of the drive plate carefully, using Special Tool 34 2 300.
 Seat the transmission case on the engine. Unscrew Special Tool 34 2 300 out of the hole towards the front.
 Secure the torque converter.



Check the ATF level after installation of the transmission.

Car must stand on a level surface.
 Check the ATF level only when the ATF temperature is between 50 and 55 °C.
 Interrogate the ATF temperature with Modis or a Service Tester (refer to Test Plans).
 Run the engine at idling speed with the selector lever in P or R.
 Unscrew filler plug (1).

Installation.
 Check the seal, replacing it if necessary.



Check and, if necessary, correct the ATF level.
 Pour in ATF through filler (2)* until it runs out of the sight bore.

Important!
 Only ATF approved for Jatox transmissions may be used.
 Insert and tighten the filler plug.
 Tightening torque*

24 00 047 Installing exchange transmission.

Remove transmission, refer to 24 00 027

Caution!

Always blow oil cooler and lines clean with blast of compressed air and rinse before refit transmission oil before installing an exchange transmission.
Use special oil.
Transmission identification and code** see label



24 00 047

Transfer transaxle holder (1)



24 00 047

Transfer liner (2) and bracket (3)
Tightening torque 24 01 18.2 *



24 00 047

Transfer oil cooler return pipe (4)
Unscrew bolts from holder



24 00 047



24 00 047

Unscrew large bolt (5).

Installation

Check seals, replace if necessary.
Tightening torque 17 22 8.8.2 *



24 00 047

Transfer cross member (6) and exhaust carrier (7)

Caution!

Automatic transmissions are supplied filled with ATF

For this reason, strictly perform an oil level check after installing the transmission (refer to 24 00 027)

* Refer to Technical Data

** Source of Supply: BMW Parts service

* Refer to Technical Data

24 11 609 Removing and installing/sealing or replacing transmission oil pan.

Remove drain plug (1).
Drain oil.

Inspect pan.
Replace seal.
Tightening torque 24 11 6A2*

24 11 411 F

Unscrew oil pump.
Take off oil pump with gasket.

Replace seal.

24 11 411 F

Clean oil pump.

Caution!
Place magnet disc (1) in oil pump.
Replace gasket (2).

24 11 420 F

Unscrew filler plug (1).

24 11 421 F

* Refer to Technical Data



24 11 420 F

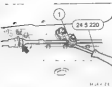
Hang filter (2)** in filter opening.
Pour in ATF until it overflows.

Caution!
Only oil grade approved for Jatco transmissions may be used.

Run engine in selector lever setting "P" or "R".
Select all settings in transmission.
Increase transmission oil temperature to approx. 30 - 55°C.
Intermittently ATF temperature with MoDc or Service Tester (refer to Electrical Troubleshooting Manual).
Recheck ATF level.
Drain excessive ATF or pour in additional ATF.
Scribe in filler plug.
Tightening torque 24 11 3A2*

* Refer to Technical Data

** Source of Supply: BMW Parts service



24 S 220

24 12 107 REPLACING RADIAL OIL SEAL FOR MANUAL SHIFT VALVE SHAFT

Remove exhaust assembly - refer to 18 00 020

Unscrew nut (1) in position P

Important!

Always counterhold on bolt using Special Tool 24 S 220 to avoid deformation of the cable.

NOT:

Special Tool 24 S 220 can only be applied in position P

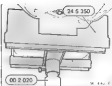
Unscrew cable from holder

Pull cable out

Installation

Adjust shift - refer to 24 00 007

Tightening torque*



24 S 350



24 S 350

Support the transmission from underneath using Special Tools 24 S 350 and 80 S 850.

Unscrew cross member from the body. Lower the transmission as far as possible

Installation

Center the transmission - refer to Gr 26

Tightening torque*

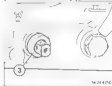
* Refer to Specifications



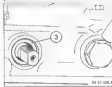
24 S 4 10



24 S 4 10



24 S 4 10



24 S 4 10

Unscrew lever (2).

Installation
Tightening torque*

Lower radial oil seal (2) out using a narrow screwdriver

Protect threads and edges of manual shift valve shaft with adhesive tape.

Lubricate sealing lip of radial oil seal with oil.

Push radial oil seal (2) over the adhesive tape up to the case.

Defeat radial oil seal (2) in using a suitable screw.

The radial oil seal must be flush with the level.

Apply

Check ATF level - refer to 24 00 027

* Refer to Specifications



24 12 506 Replace radial seal for torque converter
(transmission removed)

Remove torque converter 24 40 007
Remove radial seal (1) with special tool
24 5 010.



Lubricate sealing lip with oil.
Apply radial oil seal (1) on case



Drive radial oil seal (1) in bush using special
tool 24 1 060



Check O-ring (2) on input shaft, replace if
necessary



24-26 001 REPLACING O-RING FOR OUTPUT FLANGE

Remove exhaust assembly - refer to
18-00 026.

Unscrew propeller shaft at transmission
and center mount - refer to 24-80-037
Break output flange using Special Tool
23-0 020.

Unscrew stop nut (1).

Installation

Replace stop nut
"tightening torque"

Lever O-ring (2) out using a screw.

Installation

Lubricate O-ring (2) slightly with oil and
install it in the groove.

Note

Check ATF level - refer to 34-00-027

**24 30 008 Removing and installing or
replacing selector unit**

Refer to Repair Manual 3 Series 6/36

24.31 150 Removing and installing or
replacing transmission oil
strainer

Refer to Repair Manual 3 Series 636



**24 34 140 Removing and installing -
sealing damper cover**

Remove bolts (1 - 4).

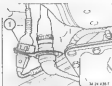
Installation note
Bolts are coated and must be replaced every
time they are assembled.
Clean thread in transmission casing before
fitting bolts.
For tightening torque*



Remove damper cover
Replace gasket (5) and O-ring (6).
Lightly oil O-ring with automatic transmission
oil**

Note!
Check oil level, refer to 24 30 027

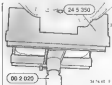
* Refer to Technical Data.
** Refer to BMW Fluids and Lubricants
Specifications



24 34 872 Replacing RPM sensor

Remove complete exhaust system (8 08 000).
Detach propeller shaft at transmission and
center bearing from body (refer to 24 00 037).

Disconnect plug-and-socket connection (1).



Support transmission with special tool
24 5 350 in conjunction with lifting fixture



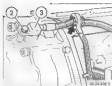
Release cross member from body.
Lower transmission as far as possible.

Installation note:
Align transmission in center (refer to HD 36).
For tightening torque*



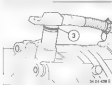
Cut open cable lines.
Detach wiring harness from holder.

* Refer to Technical Data



(2)
Pull out RPM sensor (2).
Detach wiring harness from holder.

Installation note:
For tightening torque



Installation note:
Lightly grease O-ring (3).



Detach wiring harness from front holder.



Release of cooler return line from transmission.
Push oil cooler return line away from transmission
until plug connection of wiring harness
can be disconnected.
Disconnect wiring harness.

Installation note:
Lay and secure wiring harness in same
position as before removal.

* Refer to Technical Data

**24 34 844 Replacing solenoid valves
for pressure regulator
torque converter**

Refer to Repair Manual 3 Series E 36

**24 34 845 Replacing solenoid valve for
reverse gear inhibit**

Refer to Repair Manual 3 Series E 36

**24 34 846 Replacing solenoid valve
block A B C**

Refer to Repair Manual 3 Series E 36

**24 35 506 Replacing wiring harness in
automatic transmission**

Refer to Repair Manual 3 Series 535



24-40-001

24-40-007 Removing and installing or replacing torque converter

Remove transmission. Refer to 24-60-007.
Pull torque converter out of primary pump carefully using assembly handles 24-4-000.

Caution!
Escaping ATF

Torque converters cannot be cleaned with standard workshop equipment and must be replaced when damaged.



24-40-002

Inspection:
Check O-ring (2) on input shaft, replacing if necessary.



24-40-003

Carefully guide openings on converter into primary pump by turning slightly and using assembly handle 24-4-000.

Caution!
Make sure converter bearings and seal are not damaged while guiding in.
Insert torque converter as far as stop.



24-40-004

* Refer to Technical Data

24 52 500 Replacing notched disk

Refer to Repair Manual 3-Series E 34



24-61-501 Removing and installing or replacing control unit

The control unit for 6H transmission is located in the right-hand A-pillar.
Removing and installing glovebox: refer to 61-18-360.

Remove speaker covering.
Disconnect wire for speaker.
Remove protective hood.



Partly remove soundproofing mat.
Only loosen off screws (3) - (5).



Lift out control unit and remove by pulling downwards.



Reinstall screws (1).
Disconnect plug connector (2).

The plug connector must only be disconnected and reconnected with the ignition switched off.

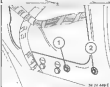
Installation note
Tightening torque 3 Nm.



Identification letter on type identification plate.
For type and model allocation, refer to 66FF
Parts Catalogue.

24-61/42 REPLACING RESISTOR FOR CONTROL UNIT

The resistor for the control unit is located in the right A pillar.
Remove glovebox - refer to 61-18-380.
Remove loudspeaker cover.
Disconnect loudspeaker wires.
Remove the protective hood.

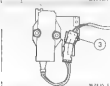


Unscrew screws (1 and 2)

Remove
"insulation engineering tongue"



Remove the resistor together with the holder upwards.



Disconnect plug (3)

* Refer to Specifications

24-11-239 Oil change in automatic transmission (4800 engine - 4.55-540 L transmission)

Note

The transmission has lifetime lubrication. Oil changes are therefore only required under exceptional circumstances.

Caution

Special oil: Refer to Lubricant Specifications.

Ensure that transmission is at full operating temperature before changing fluid.

Remove drain plug (1).
Drain oil.

Note

Dispose of oil and oil correctly.

Installation instruction.

Replace seal.

Tightening torque 24-11-542.*

2 Top Up transmission oil level

ATF*** is poured in through the filler bore underneath the oil pump.
Unscrew filler plug (1).

Installation instruction

Check seal replacing if necessary.

With engine stationary, fill with oil until it overflows.

Screw in oil filler plug and start engine. Select gear lever position "P".

Open oil filler plug and, with engine running, top up with oil until it overflows.

Caution!

If caution notices occur during the filling process, air is being drawn in. This causes the transmission oil to foam, thereby increasing its volume.

This results in an excessively low oil level. If this happens, repeat the oil level check a few hours later.

* Refer to Specifications.

** Refer to Consumables Specifications.

* Refer to Specifications.

** Refer to Consumables Specifications.

a Check oil level (cont.)

Perform the oil level check rapidly.

When the check is complete, the transmission temperature must not exceed 50° C.

It is always preferable to check the oil level at lower temperatures.

The inspection should therefore be completed at 30° C if possible.

The transmission then holds about 0.8 liters, more oil than when the oil level is checked at 50° C.

At the start of the oil level check, the transmission temperature must be between 20° and 30° C.

Read off temperature with Metric or Service Tester.

Park car on level ground.

Run engine at idle speed.

With ABS engines, switch on lights to increase engine speed.

With the engine running (idle speed), apply brake¹, slowly shift up and down all gears in "program" (selector program).

Move selector lever into position "P"² then un screw and remove oil filler plug with engine running.

Fill to ATF until it overflows.

With engine running, screw oil filler plug back in.

Installation instructions

Replace seal.

Tightening torque 24-31 N·m*

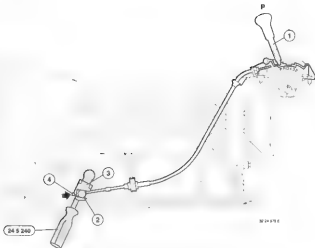
* Refer to Specifications.

¹ Source of Supply: BMW Parts Service



24 00 007 Adjusting gearshift lever

Transmission A35 160 2

**Set gearshift lever (1) to "P"****Reverse nut (2).****Caution!**

In order to avoid deforming the operating cable, the clamping screw must be held with the special tool 24 5 240.

Note:

The special tool 24 5 240 can only be fitted in position "P".

Press forward lever (3) (park position).

Press operating cable rod (4) upwards in forward direction and release again.

Fitting secure operating cable rod (4) with nut (2). (Hold with special tool 24 5 240).

For tightening torque 24 15 242.

24 00 026 Removing and installing transmission

Engine 1800 transmission
A58 180 Z

Disconnect negative lead from the battery
Caution!

First read fault memories with tester and print any faults as fault memories of control units will be canceled by disconnecting the battery.
Remove complete exhaust system 18 00 000
Remove underbody protection from engine

Remove protective cover



Unscrew heat shield (1)

Remove bracket for Lambda oxygen sensor plug



Loosen nut (1)

Caution!
To avoid distortion of the cable, always brace with special tool 24 5 340 on the clamping screw.
Tightening torque*

Note:
Special tool 24 5 340 can only be fitted in setting "P".

24 5 340 P



Remove cable sleeve from counter support. Pull out cable.

Installation instruction
Tightening torque*

Adjust shift mechanism 24 00 007

24 00 007 P

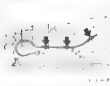


Turn (beyond) connection counter-clockwise. Pull off plugs.
Lift cable harness out of holder.

Installation instruction
Fit plug, taking care to ensure that the marker lines are aligned.

* Refer to Specifications

24 00 007 P



17 14 000 1

Unclip cable hangers on transmission.



17 14 000 2

Unscrew coolant pipes on left and right hand sides of transmission oil cooler

Note
Approximately 1 liter of coolant will run out when unscrewing the pipes

Fill cooling system - refer to 17 00 000



17 14 000 3

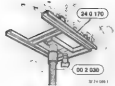
Insulation
Replace O-rings.
Tightening torque*



20 20 000 0

Unscrew stabilizer at left and right hand ends and let it hang down.

* Refer to Specifications



07 14 000 1

Support transmission from underneath using Special Tools 24 0 170 and 00 0 000.



07 14 000 2

Unscrew cross member

Insulation
Center transmission - refer to Group 26
Tightening torque*



07 14 000 3

Unscrew joint disc at transmission

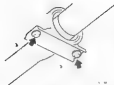


20 20 000 1

Insulation
Replace joint disc.
Tighten bolts to specified tightening torque*

Important!
Only turn nuts on flange and whatever possible by design to avoid tension in the joint disc

* Refer to Specifications

**Unscrew center mount**

Barrel propeller shaft down and pull off of centering pins on transaxle case.

Important

Do not let propeller shaft fall into pants. Suspend it high over on piece of wire.

**Installation**

Fit the center mount in forward direction by distance (A) = 2 - 4 mm. Tightening torque*



Unscrew heel shields at left and right hand sides and push forward



Turn steering wheel fully against left or right lock

Use slip out of opening in oil pump

* Refer to Specifications



24 x 110

Unscrew three torque converter to drive plate mounting bolts using Special Tool 24 x 110 and turning clockwise 1/2 turn for each bolt.



11 x 480

Apply Special Tool 11 x 480 between connecting pipe and engine oil pan.



Lower transaxle case.

Important

Exhaust manifolds must not bear on thrust strut mounts.



Unbolt transmission from engine (Torx bolts)

Note

Bolts (1) = Torx E 10

Other bolts = Torx E 10

Bolts (2) opposite the starter are fitted with nuts at front.

Installation instruction

Note that Torx screws are fitted with washers.
Tightening torque 24 05 142*



Fig. 24 05 142

Prevent torque converter from slipping out by fitting and securing special tool 24 4 120 to transmission case with flat side of retaining tab facing torque converter.
Pull transmission off engine.



Fig. 24 4 120

Caution!

To transport the transmission, lower transmission fully onto lifting fixture.
Risk of accident.
Transmission weight approx. 120 kg.

Caution!

When putting down transmission without support, do not place on oil cooler.



Fig. 24 05 142

Note dowel sleeves.

If necessary, transfer / replace dowel sleeves on transmission.

* Refer to Specification



Fig. 24 2 300

Installation instruction

Turn the torque converter on the transmission until bore (2) faces down perpendicular to the tab.
Screw special tool 24 2 300 into the tab.



Fig. 24 04 030

Installation instruction

Bore (2) on drive plate must point perpendicularly to center of opening in oil pump.



Fig. 24 04 030

Installation instruction

With automatic transmission until bore (2) in drive plate is reached.
Guide transmission in carefully with special tool 24 2 300 in bore (2) on the drive plate.
Bolt transmission case to engine.
Remove special tool 24 2 300 from tab by rotating and pulling forwards.
Bolt torque converter to flywheel.



Installation instruction:
Install bolt using special tool 24 1 110 and
tighten using a torque wrench.
Tightening torque (24 40 1A)²

Caution!
Only use original screws³

1 4 4 1



2 4 1

Installation instruction:
If necessary top up adjust transmission fluid
level, refer to 00 15 239

¹ Refer to Specifications

² Source of Supply: BMW Parts Service

24-00 045 Installing exchange transmission

- Engine 40 00 transmission ASS 140-2

Remove transmission 24-00 035.

Notes
Check transmission designation coding* on type plate or label

Check that correct electronic transmission control unit (ECU) is fitted to transmission

Fit transport container (1)



24-00 001



24-00 002

Fit lever (2), retaining angle (3) and cable clip for Lambda oxygen sensor



24-00 003

Fit left and right exhaust brackets.

Caution!

Automatic transmission is supplied with an oil fill.

After installation, simply check the transmission fluid level.

Check top up oil level, see 00-11-020

Whenever a transmission is replaced, cancel the ECU adaptation memory using the Service Tester and perform a new adaptation procedure.

Perform at least five (1-2, 2-3, 3-4, 4-5) several times in E program and setting "02" at a range of different accelerator positions (low, medium, high part throttle, full throttle). Perform several repeats of shifts which have been the subject of complaint.

24 00 585 Disassembling and assembling automatic transmission (A55 5602)

Refer to Repair Manual 7 Series E38



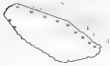
**24 11 000 REMOVING AND INSTALLING
SEALING TRANSMISSION OIL
PUMP**

Unscrew drain plug (1).
Drain oil.

Note
Dispose old oil properly.

If applicable
Fill transmission with oil. Refer to "Oil
Change in Automatic Transmission" in
60 11 226 of Group 3d.

Strip/rew oil pump bolts.
Remove oil pump and gasket.

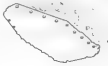


24 11 280 F



24 11 281 F

Installation
Clean oil pump.
Install magnets.
Hold new gasket on oil pump by using
glycerine grease.



24 11 282 F

Installation
Tighten bolts uniformly in several steps.
Torqueing torque*

Lift inspection tank off of oil pump.



24 11 283 F

If applicable: If oil retainers, remove and
clean magnets.



24 11 284 F

* Refer to Specifications

24 12 016 REPLACING RADIAL OIL SEAL FOR OUTPUT FLANGE

Note

The output flange can no longer be removed from the outside.
The transmission extension must be taken off for removal of the output flange.

Remove exhaust assembly - refer to 18 00 000

Remove heat shield (1)

Unscrew holder for oxygen sensor plugs.

Loosen nut (1).

Important!
Always counter hold on ball using Special Tool 24 5 240 to avoid deformation of the cable.
Tightening torque*

Note
Special Tool 24 5 240 can only be applied in position "B".

* Refer to Specifications

Unscrew cable adjust at counterholder.
Pull out cable.

Installation
Tightening torque*

Adjust selector lever - refer to 24 00 000*

Support transmission from underneath using Special Tools 24 0 170 and 50 2 030.

Unscrew drive member

Installation
Center transmission - refer to Group 26.
Tightening torque*

Unscrew joint drop at transmission

* Refer to Specifications





Installation
Replace stop nuts.
Tighten bolts to specified tightening torque.

Important
Only turn nuts on flange end whenever possible by design to avoid tension in the joint disc.



Uncrew center mount
Wind propeller shaft down and pull off of centering pins on transaxle case.

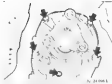
Important
Do not let propeller shaft fall into joints.
Suspend it from car on piece of wire.



Installation
Press center mount in forward direction by distance (As a 2-4 mm).
Tightening torque.

Lower transmission as far as possible

Refer to Specifications



Uncrew transmission extension.
Installation
Tightening torque.



Pull off transmission extension
Installation
Replace O-ring.



Installation
Check for shim.
Install same shim (same thickness) again.



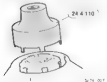
Knock back 1/4" of scored nut.

Refer to Specifications

Clamp special tool 24-0 180 in vice.
Fit transmission extension with output flange
in the special tool.



Release locked nut with special tool 24-4 110
Installation note:
For tightening torque*



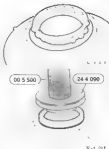
Remove transmission extension from special
tool.
Pull output flange out of mounting.



Lift out radial oil seal



Caution!
Bearing inner race and balls with cage can
drop out.
Observe installation direction.



Fit new radial oil seal flush with special tool
24-4 090 in conjunction with handle 00-5 500



* Refer to Technical Data.

24 12 106 Replacing radial oil seal for manual shift valve shaft

Note
On completion of work, check transmission oil level and correct as required, refer to 24 11 339

Set selector lever to position "P"

Fit special tool 24 5 240 on gearshift lever

Note
Special tool can only be fitted in position "P"

Release nut (1)

Installation note
Adjust gearshift lever refer to 24 00 607

Remove operating cable sleeve from support bracket and pull out

Installation note
For tightening torque 25 18 142*

Release nut
Detach gearshift lever

Installation note
For tightening torque 24 01 142*

* Refer to Technical Data



Remove upper oil seal from transmission casing with special tool 24 5 260

Installation note
Fit special tool 24 5 490 on manual shift valve shaft

On testing tip of radial oil seal (1) with automatic transmission oil
Slide gear on radial oil seal (1) up to casing

Installation note
Press radial oil seal into transmission casing with special tool 24 5 250.
Remove special tool 24 5 490 from manual shift valve shaft.

Note
The radial oil seal on the right-hand side of the transmission is replaced in the same way



24-12-508 Replacing radial oil seal for torque converter

Remove torque converter (24-40-806)

Level out snapping with axial screwdriver



Left pull radial oil seal with open-ended wrench (24-4-13)



Installation note

Note washer under radial oil seal



24-4-130

Oil new radial oil seal and install with special tool (24-4-130)



24-4-130

24-13 154 Replacing output flange

Remove output flange
(refer to 24-13 016).

Caution

axial clearance must be checked and adjusted if necessary.

Clutch transmission extension in vice

Output flange must not rest on vice

Press output flange in output direction



32 14 154 0

Calculation example

$B = 45,1 \text{ mm}$

minus $A = 42,7 \text{ mm}$

Distance $= 2,4 \text{ mm}$

minimum 0,25 - 0,48 mm axial clearance

Calculated thickness of spacer ring

$= 2,15 - 1,90 \text{ mm}$

Spacer rings are available from parts service from 1,0 - 3,2 mm in steps of 0,2 mm.

Install required spacer ring (2 0 mm)



Determine dimension (A) from support shoulder to the sealing surface

Press down output flange for this purpose

Example

$A = 42,7 \text{ mm}$



Determine dimension (B) from sealing surface of transmission casing to shoulder on spring

Example

$B = 45,1 \text{ mm}$

24 13 106 REPLACING BEARING OF TRANSMISSION 2nd REDUCION -
 - Output Flange Removed -

Put ball in ball oil seal



Installation
 Drive in new output oil seal flush using
 Special Tools 24 1 990 and 24 1 500



Remove both inner races



Remove clamp



Remove ball cage

Installation
 Check installed direction.



Heat transmission extension in area of
 bearing hole to about 80 °C using a hot air
 blower
 Remove bearing race

Installation
 Heat case again
 Install first ball cage



Important!
 Axial play must be checked * adjusted if
 necessary refer to 24 13 058

**24-30-006 REMOVING AND INSTALLING
REPLACING VALVE BODY**

Remove oil pump - refer to 24-11-008



Unscrew oil strainer on valve body



Remove oil strainer
Check for O-ring rings

Installation
Tightening torque*



Pull plugs off oil separator

* Refer to Specifications



Unscrew holder



Pull out pulse sender
Using wire



Installation
Check routing of wires



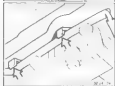
Unscrew all bolts with large bolt heads
(4 x 12 mm)
Remove valve body

Installation
Tighten all bolts in several steps
Tightening torque*

* Refer to Specifications



Installation note
During assembly fit slide valve on pin at
notched slot.



Detach wiring harness from retaining lug.



Installation note
Replace O-rings
Note centering pin.



If necessary convert bushes.
Replace O-rings.



24-31/50 REMOVING AND INSTALLING REPLACING TRANSMISSION OIL STRAINER

Remove oil pump - refer to 24-11/005.
Unscrew oil strainer on - valve body



Remove oil strainer
Check O-ring (1)

Installation
Tightening torque*

**24 14 004 REMOVING AND INSTALLING
OR REPLACING PARKING
LOCK (RAW, SPRING)**

Remove oil pump - refer to 24 11 008
Remove transmission extension - refer to
24 12 018

Lift wire retainer for pulse sender
Pull out pulse sender

Important
Tightening torque*

Unscrew guide plate

Important
Tightening torque*

Insulation
Check arrangement of ledgins

* Refer to Spectaculo

Drive out bearing shaft from inside to out-
side using a suitable 5.0 mm dia. plastic
punch

Remove parking rock lever and spring

Installation
Attach spring to bore and retainer

Important
Replace seal on bearing shaft

Lift off shim and parking lock gear

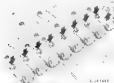
Important
If the parking lock gear is replaced, the
teeths of the shaft must be recalculated
refer to 24 13 104

24 34 857 REPLACING SOLENOIDS AND OR PRESSURE REGULATOR

Remove oil pump - refer to 24 11 008.



Pull concerned plugs off oil solenoids.



Unscrew retaining rail.

Installation
Tightening torque*



Installation
The retaining rail is curved in direction of the valve body

* Refer to Specifications



Pull out solenoid or pressure regulator



Note
Solenoids cannot be mixed up

1 = Solenoid
2 = Pressure regulator - 13 mm dia. pin
3 = Pressure regulator - 17 mm dia. pin



Installation
Check for Galling
Turn solenoids in such a manner that pins face in direction of the oil pump.

24-34/52 REPLACING PULSE SENDER (TURNING SPEED) Oil Pump Removed -

Remove oil pump - refer to 24-11-008



Unsnap off streamer on valve body



Remove oil pump
Check for O-ring (1)

Installation
Tightening torque*



Install holder

Installation
Tightening torque*

* Refer to Specifications



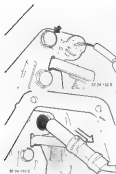
Pull out pulse sender
Take wiring out of holders
Disconnect plug



Installation
Check routing of wiring

**34 34 874 REPLACES PULSE SENDER
(OUTPUT SPEED)
- Oil Pump Removed -**

Remove oil pump - refer to 34 11 908.



Insert screw

Installation

Tightening torque*

**Push oil pulse sender
Disconnect plug**

* Refer to Specifications

24 35 501 **REAR, ACING WIRE HARNESS ON
AL TOMATIC TRANSMISSION**
- (Valve Body Removed) -

Remove valve body - refer to 24 11 228.

Note
Removal is necessary to be able to attach
the wire harness in relation to the valve
body.

Unfasten retainer
Apply Torque
Tightening Torque*

Pull out pulse sender
Disconnect plug

Remove retainer
Pull out plug towards inside.

* Refer to Specifications

Disassembly
Check O-rings, replacing them if necessary

Installation
Lock plug with retainer on body to prevent
leaking.

Installation
Check routing and colors of wires.

1 = brown
2 = yellow





24-40 000 Removing and installing • replacing torque converter

Remove transmission, refer to 24-00 000.
Using assembly handles 24-4 000, carefully pull torque converter out of primary pump.

Caution¹
Transmission oil flows out.

The torque converter cannot be cleaned with standard workshop equipment and must be replaced if damaged.
Converter identification²

Installation note

While turning slightly, carefully fit the recesses on the torque converter in the primary pump. Use assembly handles 24-4 000 for this purpose.

Caution¹
Do not damage converter bearing rings and seal when fitting. Fit torque converter as far as it will go against stop.

Note

The torque converter is engaged correctly in position when the distance between the casing and threaded connection on the converter is approx. 25 mm.



¹ Refer to Technical Data

24-61 50S REMOVING AND INSTALLING REPLACING CONTROL UNIT (EGS)

Detach electronic box and right-hand pipe
hanging behind in case

Installation

Check for wires on wire harnesses

Pull plug off of control unit

Pull out retainers.

Pull out control unit

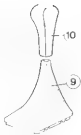
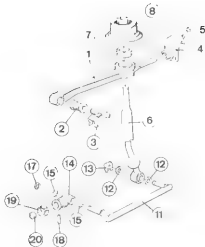
Installation

Insert control unit with openings on case
in retainers at securing points.

Code is on data plate.
Refer to Parts Catalog for cross reference
of versions and models.

25 Gear shift mechanism

	Layout of gear shift mechanism	25- 11/0
25 11 000	Shift lever – remove and install	25- 11/1
041	Spherical shell for shift lever – replace	25- 11/3
081	Imitation leather dust cover for shift lever – replace	25- 11/4
111	Shift rod joint – replace	25- 11/5
211	Selector arm for shift lever mounting – replace	25- 11/6
245	Support bearing for selector arm – replace	25- 11/7
	Layout of gear shift mechanism for automatic transmission	25- 16/0
25 16 050	Shift lever complete with shift lever bracket – remove and install	25- 16/1
061	Knob for shift-over – replace	25- 16/2
078	Pull rod in shift lever – replace	25- 16/2
	Interlock function – check	25- 16/3
	Shift lock function – check	25- 16/3
	Shift lever complete with shift lever bracket – remove and install	25- 16/4
080	Shift lever – remove and install or replace	25- 16/7
202	Operating cable for gear selector lever – replace	25- 16/9



32 25 058

SHIFT LAYOUT DRAWING
• Manual Transmission •

- 1 Shift console
- 2 Bearing sleeve
- 3 Bearing shaft
- 4 Bearing bracket
- 5 Nut
- 6 Shift lever
- 7 Mount
- 8 Rubber cover
- 9 Leather cover
- 10 Shift lever knob
- 11 Shift rod
- 12 Washers
- 13 Retainer
- 14 Shift rod joint
- 15 Spacers
- 16 Retainer
- 17 Cylindrical pin
- 18 Spring sleeve
- 19 Lubricating oil

25 11 500 REMOVING AND INSTALLING SHIFT LEVER

Remove knob off of shift lever

Note:
Pulling off requires a force of about
40 lb (80 lbs.).



25 11 500-1

Remove insulation sheet.

Precaution:

Rubber mat is located between carpet
and center console.

M 6
The shift lever knob is illuminated.
Watch out for electric leads while
pulling off.



25 11 500-2



25 11 500-3

M 6
Disconnect plug (1).
The shift lever knob can only be
replaced together with the electric
leads.
This requires pulling the plug out
through the dust cover.

**Lift front end of cover out of the
retainers.**
Lift off cover with dust cover.



25 11 500-4

Unbutton dust cover on body and shift
console.



25 11 500-5

Insulation
Engage retainers at rear and clip in at
front.



25 11 500-6

Installation
Button inner dust cover over selector
arm and outer dust cover in body
opening.



25 11 500-7



Lift out retainer (1).
Take off washer (2).
Pull out selector rod (3).

Apply Special Tool 25 1 100.
Turn counterclockwise 90°.
Press up spherical plate.



Installation
Mount spherical plate in such a
manner that tabs on spherical plate are
aligned with openings in selector arm.
Press in shift lever until retainers are
heard to engage on the left and right
sides.



Take out shift lever from above and
unbutton in dust cover.





25 11 041 Replacing spherical shell for gearshift lever

Remove gearshift lever 25 11 00
Remove spherical shell by pressing down

Installation note:
Grease spherical shell and ball with Klüber
Polybus 04, 1 001*

1 1 1

25-11 081 REPLACING DUST COVER FOR SHIFT LEVER

Pull off shift lever knob

Note:

Force required for pulling off
approx. 40 kg (88 lbs.)



Fig. 15-11-1

Push top of cover out of retainers.

Left off cover with dust cover



Fig. 15-11-2

Preparation

Engage retainers at rear and clip in at front



Fig. 15-11-3

Unhook dust cover on cover



Fig. 15-11-4

25 11 111 Replacing shift rod joint

Remove propeller shaft at transmission, refer to 25 11 000

Engage reverse gear

Remove retainer (1)

Remove washer (2)

Pull out shift rod (3)



Lift retaining sleeve out of groove and slide forward.

Drive out pin.
Pull out shift rod with pin.Installation note
Check damping disk in joint and replace if necessary

Shift bearing bush is left side

Lever out retaining ring (1)
Remove washers (2)
Pull out shift rodInstallation note:
Install washers (2) such that the chamfer faces
away from the shift rod joint.
Grease bearing points with Klüber Polyfab
GLY 801*



25 11 000

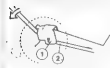
25 11 211 Replacing selector arm for gearshift lever mounting

Remove propeller shaft of manual transmission, refer to 25 11 000
Remove gearshift lever 25 11 000.
Support transmission
Unscrew cross member
Lower transmission down to front axle center



25 11 040 F

Fit screwdriver between spring and housing.



25 21 140 F

Detach spring (1) from lug (2) on housing and control up.
Remove pivot pin

Installation note:
Grease pivot pin with KlüberPolylub (GLY 80)*



25 11 03 1 F

Detach back clip.
Remove pivot pin
Detach selector arm

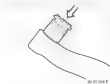
* Source of supply: BMW Parts Service



25 21 020 F

Remove selector arm from rear mounting

Installation note:
Check support ring and grease with Klüber
Polylub (GLY 80)*



25 21 020 F

Replace bearing bush(es)

Press out old bearing bush(es).
Coat new bearing bush(es) with Greasolight*
and press into selector arm hole until side
beading of bush(es) project evenly

* Source of supply: BMW Parts Service



25 11 245 Replacing support bearing for selector arm

Remove exhaust system 18 00 020.
Remove fuel shutoff.

Release Bolt



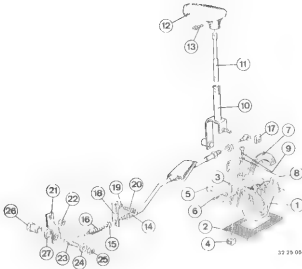
Slide bearing bracket forward, turn, press down selector arm and remove support.



Installation note:
Grease support bracket with Klüber Polyub
DIL 7 801*
Attach bracket to retaining lug.

* Source of supply: BMW Parts Service

SHIFT LAYOUT DRAWING
- Automatic Transmission -



- 1 Console
- 2 Insulator
- 3 Self-tapping screw
- 4 Self-tapping nut
- 5 Bearing shaft
- 6 Cotter pin
- 7 Bracket
- 8 Washer
- 9 Screw
- 10 Selector lever
- 11 Pull rod
- 12 Handle
- 13 Filler head bolt
- 14 Cable
- 15 Nut
- 16 Cover
- 18 Holder
- 19 Washer
- 20 Filler head bolt
- 21 Lever
- 22 Nut
- 23 Clamping bolt
- 24 Washer
- 25 Nut
- 26 Sleeve
- 27 Washer

25 16 060 Removing and installing selector lever with console

Pull off EOL switch - remove plug



Unscrew tiller head screw (2 mm hexagon socket)
Pull off handle



Installation instruction
Engage pin of button in hole of pull rod



Remove front cover from retaining lug
Remove cover



Note
To fit the EOL, push up between transmission tunnel and console with a flat object (e.g. wooden ruler).



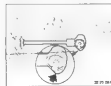
Installation instruction
Attach retaining lugs from back, clip in at front

Fit pull retainer
Unfasten lug from bolt

Caution!
Do not bend steel wire



Installation instruction
Lug on the eye points upwards.



Uncover nut.
Disconnect Borelon cable sleeve from retaining bracket.



Uncover bolts.



Press together the retaining clips.
Disconnect plug.



Removing selector console and protective cover.

Installation instruction:
Examine, replace protective gasket.
Adjust selector mechanism, see main group 24.



25-16 004

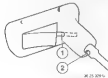
25-16 001 Replacing handle for selector lever

Uncover Borelon head screw (3 mm hexagon socket).
Put off handle with pull rod.



Installation instruction:
Tightening torque*

Disconnect pull rod (button not pressed).
Engage pin (1) of button in bore (2) of pull rod.



25-16 002

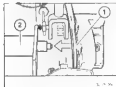
25-16 002 Replacing pull rod in selector lever

Description given in Replacing Handle For Selector Lever, see 25-16 001.

* Refer to Specifications

CHECKING INTERLOCK

Turn ignition key to center position (neutral).
 It must be possible to move the selector lever in and out of all positions.
 It should only be possible to turn the ignition key back to "Zero" position and reinsert the key with the selector lever in P.
 It must not be possible to move the selector lever out of P with the ignition key in "Zero" position or removed.



- 1 Interlock
- 2 Shiftlock

CHECKING SHIFTLOCK

With the engine running and car stopped the selector lever must be in P or R.
 With the brake pedal operated and an engine speed of less than 1500 rpm the selector lever must be unlocked.
 With the brake pedal operated and an engine speed of more than 1500 rpm the selector lever must be locked in P or R.
 When moving the selector lever quickly from R to D and from D to R the selector lever lock must not be actuated in position R.

If the selector lever is left in position R for longer than about 5 seconds the lock must be actuated.

Except for positions P and R, the selector lever must never be locked regardless of the operating condition.

The selector lever lock must not be activated at a road speed of more than 5 km/h.

25 15 Removing and installing selector lever and console

Version with Interlock/Shift-Lock

Lift out switch for BGS control unit, remove plug.

Undo the starter head screws (3 mm hexagon sockets)
Remove handle.

Installation instruction:
Insert pin in button in base of pin rod.

Lift out front cover from retaining lugs
Remove cover

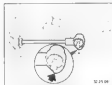
Installation instruction:
Attach retaining lugs at back and clip in at front.

Lift out clamping spring.
Unscrew eye on bolt.

Caution!
Do not bend steel wire.

Installation instruction:
Lug on the eye points downwards.

Unscrew and remove nut
Detach Bowden cable sleeves from retaining bracket.





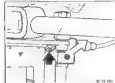
32 25 064 7

Press together retaining clips.
Disconnect plug.



32 25 065 1

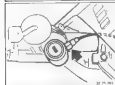
Unscrew screw (1).



32 25 066 1

Unscrew handle.
Disconnect interlock cable.

In operation instruction.
Adjust interlock cable.



32 25 067 1

Fit new interlock cable, see Replacing Interlocking Locks, main group 32.



32 25 068 1

Detach plug connection for interlock.



32 25 069 1

Unscrew bolts.



32 25 070 1

Remove console and protective cover.

Installation instruction:
Examine protective gasket and replace if necessary.
Adjust gearshift mechanism, see main group 24.



32 25 071 1

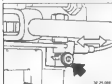
Assembly and adjustment.
Interlock cable.
Move selector lever into setting "P" (front idler on bearing post).



Connect cable system on pin of lever



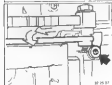
Check function of interlock and shifter



Fit cable with bracket and screw on bearing pin (cable tubes must initially retain axial movement in the bracket)



Move ignition key into start setting (remove ignition key)



Press start lever down and tighten screw for retaining cable to torque of 8 Nm

25-16 080 Removing, installing and replacing selector lever

Remove transmission, clutch.
Remove screws.



25-16 080 I

Move selector lever into central position.
Lift off switch.



25-16 080 II

Installation instruction:
Align slot in housing and guide groove in slide
with one another (i.e. align them).
Check that the driver signal is correctly
located.



25-16 080 III

Remove selector lever.
Remove pull rod.



25-16 080 IV



25-16 080 V

Unfasten collar pin.

Press out both
(Press 1X).



25-16 080 VI

Installation instruction:
Note installation direction of both.



25-16 080 VII

Remove selector lever from housing.

Installation instruction:
Lubricate bearing surfaces with MÖller Poly-
top GS 1501** grease.



25-16 080 VIII

** Source of Supply: BMW Parts Service

Replacing Bearing Sleeves**Drive both bearing sleeves out**

25 16 009 1

Press new bearing sleeves in both**Press new bearing sleeves in both**

25 16 009 1

25-16 202 Replace cable for gear selector lever



32 25 011 1

Unstick nut (7) in setting "P"

Caution!

To prevent any distortion of the cable, brace with special tool 24 5 210 or 24 5 230 in the clamping series.

Transmission A 4 5 310 R
Special tool 24 5 210.

Transmission A 5 5 310 Z and A 5 5 300 J
Special tool 24 5 230.

Note:

The special tool can only be fitted in setting "P".

Unscrew cable from holder



32 25 011 2

Installation instruction:
Note the arrangement of washers.
Check: replace rubber insert.



32 25 011 3

Lift out switch for BH control unit, remove plug.



32 25 011 4

Unstick clamping screw (5 mm hexagon socket).
Remove handle.



32 25 011 5

Installation instruction:
Insert pin of button in pin 1 red form.



32 25 011 6

Lift cover out from front of retaining lugs.
Remove cover.



32 25 011 7

Installation instruction:
At each retaining lug at rear and clip into place at front.



32 25 011 8

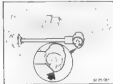
1. Fit out clamping spring.
Unfasten eyesel from both.

Caution!
Do not bend steel wire



25-15-079-0

Installation instruction:
Lay on the eyesel points downwards.



25-15-080-0

Unscrew and remove nut.
Detach Bowden cable sleeve from retaining
bracket.



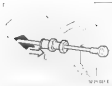
25-15-074-0

Cut open carpet and hammer into place



25-15-028-0

Remove rubber grommet together with Bowden cable.



25-15-081-0

Installation instruction:
Insert Bowden cable from top.
Bottom up rubber grommet.



25-15-022-0

After complete assembly of the Bowden cable,
check location of rubber grommet once again.
Adjust shift mechanism, see main group 24.

26 Propeller shaft

26 11 000	Propeller shaft – remove and install	26- 11/1
030	Propeller shaft – balance (center and adjust deflection angle)	26- 11/8
051	Flexible coupling for front propeller shaft – replace	26- 11/8
160	Constant velocity joint for propeller shaft – replace – version with press-fitted shrutted bolts	26- 11/8
180	Constant velocity joint for propeller shaft – replace – version with screwed stud bolt	26-11/10
501	Centering for propeller shaft at front – replace	26-11/12
26 12 001	Propeller shaft center mount – complete unit – replace – propeller shaft with sliding member on center mount	26- 12/1
001	Propeller shaft center mount – complete unit – replace – propeller shaft without sliding member on center mount	26- 12/2
002	Both propeller shaft center mounts – complete units – replace	26- 12/3
011	Grooved ball bearing in propeller shaft center mount – replace	26- 12/5
500	Propeller shaft center mount – preload and check	26- 12/5
26 20 000	Input shaft – 4-wheel drive – remove and install	26- 20/1
051	Flexible coupling for input shaft – 4-wheel drive – remove and install	26- 20/2
	Propeller shaft – troubleshoot	26- 90/1



26-11-008 REMOVING AND INSTALLING PROPELLER SHAFT

Remove exhaust assembly - refer to

Note

The propeller shaft is adapted to permanent requirements in reference to the draft angle and version, power flow and vibration behavior so that removal and installation will differ and depend on the version.

Remove the heat shield if applicable.

Version with Front Joint Disc

Unscrew the joint disc at the transmission

Preparation

Note the length of bolts due to the thicker joint disc for the MS.

1/16 335 = 54 mm
1/16 = 60 mm



Installation

Replace the stop nuts.
Tightening torque*

Important!

Only tighten the nuts or bolts on the flange and whenever possible to avoid tension in the joint disc.

Note

The vibration damper is mounted on the transmission end of the output flange. By turning 60° the vibration damper can be pushed over the output flange.



Turn the vibration damper 60° and lay it on the rubber coupling.
The vibration damper is removed together with the propeller shaft.



Version with Front Universal joint

Support the transmission from underneath.
Unscrew the transmission suspension.

Installation

Center the transmission - refer to Qr 26.
Tightening torque*



Unscrew the universal joint from the transmission.

Installation

Replace the stop nuts.
Tightening torque*



using Special Tool 26-1-540.

Preparation

Tighten the threaded bush after complete installation, using Special Tool 26-1-540.
Tightening torque*

* Refer to Specifications

* Refer to Specifications



Removing propeller shaft from rear axle differential

Caution!
Draw relative positions of flanges



Version with universal joint

Universal differential joint on transmission

Installation instruction
Replace stop nuts
Note tightening torque 26-11-642*



Version with constant velocity joint

Unsprung universal joint on rear axle differential

Installation instruction
Replace stop nuts

Caution!
The tightening torque 26-11-642* for M10 bolt connections can differ depending upon the version of nuts used.



Installation instruction
Check replace gasket.

Caution!
The constant velocity joint is not interference-mounted.
Protect joint from dirt with transport cap or similar item.
Check grease fill*

* Refer to Specifications



Remove center mount from body

Installation instruction
Preload center mount in forward direction
Tightening torque 26-11-642*

Preload on propeller shaft's sliding member on center mount $A \pm 4 - 8$ mm
Propeller shaft's sliding member on center mount $A \pm 2 - 4$ mm



Model 315:
Three-piece propeller shaft.
In addition, remove second center mount from back of body

Installation instruction
Preload center mount in forward direction in parallel (upward) $A \pm 2 - 4$ mm



Band down propeller shaft at center mount and withdraw from centering spigot on transmission

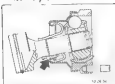
Remove propeller shaft
The propeller shaft is balanced in the driveline and may only be replaced as a complete unit.



Do not separate propeller shaft on sliding member

Propeller shaft sections are mounted in such a manner that the universal joints are in one plane.
If the sliding member was inadvertently dismantled without marking, the only mistake possible is incorrect assembly (offset at 180°) due to the balancing operation.

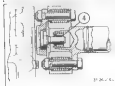
* Refer to Specifications



10 26 11/3

Important!

Do not let the propeller shaft hit any of the joints. The rubber cover of the constant velocity joint in particular would be damaged.



10 26 11/3

Preparation

Check center (4)

Replace a damaged center

Lubricate the center with Molykote Long-term 3rd prior to installation

26-11-030 BALANCING PROPELLER SHAFT (CHECKING AND ADJUSTING DEFLECTION ANGLES)

WARNING: Notes:

Requirements:

Propeller shaft in perfect optical condition.
Balance the propeller shaft. If balance plates are missing or there is suspicion of propeller shaft imbalance (refer to the operating instructions supplied with the balancing machine).

Important:

Tool run is jacked up car only with supported wheel suspension on the driven wheels (deflection angle of output shaft).
Never exceed the top speed specified for a car in jacked-up state or on a dynamometer test stand.

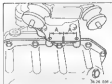
Conform with safety precautions!

Centering Propeller Shaft:

Detach the exhaust assembly, engine rubber mounts and transmission cross member.
Apply Special Tool 26-1-030.

Measuring Point:
Bore in engine center at rear.
Manual transmission - center cast IR.

4 HP 22/3 HP-18 Automatic Transmissions.
Center bolt of transmission extension (punch mark the measuring point).



THM 91 Automatic Transmission:

Determine the measuring point.
Measure distance A from the center of the bore to the inside.
A is 31.8 mm.
Punch mark the measuring point.

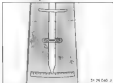
Move the transmission sideways until the special tool gauge shows the same distance on the left and right sides.
Mount the cross member.
Tightening torque*

Checking Deflection Angle of Propeller Shaft:

MAN Engines
Clamp rail (steel ruler) on the pulley in vertical position (use a clamp).
Place Special Tool 26-1-030 on the rail.

MDX/MD Engines
Clamp rail (steel ruler) on the vibration damper in vertical position (use a clamp).
Place Special Tool 26-1-030 on the rail.

* Refer to Specifications



Set the indicator perpendicular with help of the indicator base.

Note

Always apply the special tool with the scale in the same direction (e.g. scale right).

One graduation = 2°

The position of the car is not important as only separate angles are compared.



Place the special tool on the right section of the propeller shaft and measure the angle.

Determine the deflection angle* of the joint disc and, if necessary, correct it by installing max. 3 mm thick shims on the transmission suspension or center mount.

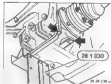
Example

Engine angle	= 2° 16'
Propeller shaft angle	= 2° 08'
Joint disc deflection angle	= 0° 10'

Note

When correcting deflection angles by installing shims, remember that this will change the deflection angle of the neighboring joints.

In general a small as possible deflection angle on joints would be ideal.



If a machined surface is accessible on the rear axle final drive, Special Tool 26 1 030 may be applied on the machined surface. Measure the deflection angle*



Place Special Tool 26 1 030 on the rear section of the propeller shaft and measure the angle.

Determine the deflection angle* of the center mount and, if necessary, correct it by installing shims of up to max. 3 mm thick next on the transmission suspension or



Place Special Tool 26 030 on the rear axle final drive together with a rail (steel ruler). Measure the deflection angle*

* Refer to Specifications

* Refer to Specifications



26-11 001 REPLACING FRONT JOINT DISC FOR PROPELLER SHAFT

Remove exhaust assembly - Refer to 18 00 020
Remove the heat shield if applicable

Note

The propeller shaft is adapted to perform requirements in relation to the transmission version, power flow and vibration behavior, so that removal and installation will differ and depend on the version.

Unscrew the joint disc at the transmission

Installation

How the length of bolts due to the thicker joint disc for the IS3
 IS3H IS3H = 55 mm
 IS3 = 60 mm



Installation

Replace the stop nuts.
Tightening torque*

Propeller

Only tighten the nuts or bolts on the flange and whenever possible to avoid tension in the joint disc.



Note

The vibration damper is mounted on the transmission end of the output flange. By turning 90° the vibration damper can be pushed over the output flange.



Turn the vibration damper 90° and lay it on the rubber coupling.
The vibration damper is removed together with the propeller shaft.



Version with Slide

Loosen the threaded bush (screw) nuts, using Special Tool 26-1 040.

Tighten the threaded bush after complete installation, using Special Tool 26-1 040.
Tightening torque*

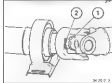


Unscrew the center mount from the body

Installation

Preload the center mount parallel in forward direction.
Tightening torque*

Preload the center mount by distance A = 4 to 6 mm for propeller shafts with a slide or by distance A = 2 to 4 mm for propeller shafts without a slide.



Slide slide

Three-piece propeller shaft.
Unscrew the second center mount at rear from the body

Installation

Preload the center mount parallel in forward direction by distance A = 2 to 4 mm.



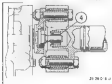
26 11 001



26 11 017



26 11 018



26 11 019

Band the propeller shaft down and pull it out of the centering pin on the transmission.

Important:

Do not disconnect the propeller shaft at the slide.

The propeller shaft was balanced in an assembled state and may only be replaced as a complete assembly.

Suspend the propeller shaft from the car on a piece of wire.

Important:

Do not let the propeller shaft fall into the holes. The rubber cover of the constant velocity joint in particular would be damaged.

Unscrew the joint disc from the propeller shaft.

Important:

The joint disc must be installed that the screws point to the flange area.

Replace the self-locking nuts.

Tightening torque:

Only tighten the nuts or bolts on the flange and to avoid tension in the joint disc.

Installation

Check center (4).

Replace a damaged center.

Lubricate the center with Molykote Long term 2** prior to installation.

** Refer to Specifications

** Source of Supply: BMW Parts



26 11 163 REPLACING CONSTANT VELOCITY JOINT FOR PROPELLER SHAFT
Version with Pressure Knurled Head Bolts -

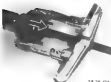
Remove complete propeller shaft - refer to 26 11 008
Remove hose strap

26 16 117



LIB circlip out
Installation
Replace the circlip

26 16 101



Press constant velocity joint all together with the dust cover

26 16 104



Press knurled head bolts and washers out of the constant velocity joint

26 16 105



Press dust cover on

26 16 108



Fill new constant velocity joint with 50 grams of 'grease'

NOTE
Don't coat the inner race with grease as the balls would fall out

26 16



Place the gasket on the shoulder (provided for this purpose)
Press dust cover on

CAUTION
Check for correct positioning of the bones

26 16 107



Press knurled head bolts in together with washers

26 16 109

* Source of Supply: BMW Parts



26 10 0

Clean the splines to remove grease and coat with a thin cement**

Important:

Keep the ball cement out of the ball paths



26 10 10

Once the constant velocity joint enters the propeller shaft using Special Tool 23 1 040



26 10 10

Install the circlip

Note:

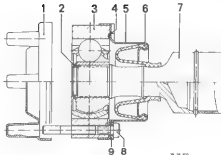
Check for correct and tight fit



26 10 10

Install hose clamp on the dust cover

CONSTANT VELOCITY JOINT DRAWING



26 10 10

- 1 Transporting cap
- 2 Circlip
- 3 Constant velocity joint
- 4
- 5
- 6
- 7 Propeller shaft
- 8
- 9

26-11-180 REPLACING CONSTANT VELOCITY JOINT FOR PROPELLER SHAFT Version with Screws-in Studs

Remove complete propeller shaft refer to 26-11-000.
Remove Roto strip.



26-08-036

Lift strip out.

Installation
Replace the strip.



26-08-038

See through the steel metal sleeve along the line all around.



26-08-037

Push the sleeve back.
Apply Special Tool 26-1-070.
Pull the constant velocity joint off using a standard puller.



26-08-035

Fill new constant velocity joint with 80 grams of grease.

Note:

Don't sand the inner race with sand as the balls would fall out.



26-08-039

Clean the splines to remove grease and coat with a bolt cement.

Important!

Keep the bolt cement out of the ball paths.



26-08-043

Drive the constant velocity joint onto the propeller shaft using Special Tool 26-1-040.



26-08-041

Install the strip.

Note:

Check for correct end-tight fit.



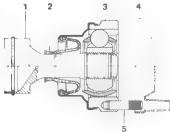
26-08-040

install hose clamp on the dust cover



26 26 019

CONSTANT VELOCITY JOINT DRAWING



- 1 Proper shaft
- 2 Dust cover
- 3 Constant velocity joint
- 4 Transporting cap
- 5 Shaft

**26-11-581 REPLACE CENTER FOR
FRONT END OF PROPELLER
SHAFT**
Propeller Shaft Rampover *

Fill the center with viscous grease and
drive it out using Special Tool 11 1 130.
Pressure on the grease filling drives the
center bearing out.



(4) 26 0 0 18

Lubricate the center with Molykote using
screw 277 and drive it in using Special Tool
11 1 130.
The bearing lip faces down.



(4) 26 0 0 28

Protrusion A = 4 to 8 mm.



(4) 26 08 0 00



26-12/01 REPLACED PROPELLER SHAFT CENTER MOUNT - Propeller shaft with slide on Center Mount

Removes propeller shaft - refer to 26-11/000.
Unscrew threaded bush using Special Tool 26-1040.
Pull off front section of the propeller shaft.

Important:

The propeller shaft was balanced in an assembled state and may not be turned in the slide.
Note the paint marks.
Mark an unmarked propeller shaft.

Installation

Lubricate the slide with Molykote Longterm 3".
Install threaded bush (1), washer (2) and rubber ring (3).
Assemble the propeller shaft that the paint marks are aligned.



Note

The propeller shaft sections are mounted in such a manner that the universal joints are in line (axis).
If the slide had been previously disassembled without marking, wrong installation of only 180° is possible due to the balancing.



Installation

Tighten the threaded bush after completed installation using Special Tool 26-1040.
Tightening torque*



* Refer to Specifications.
- Source of Supply: B&B Parts



Loosen (4) and remove dust guard (5).



Pull the center mount off together with the greased ball bearing.
Use a standard puller.



Install dust guard (1).
Drive the center mount on to fit tight using Special Tool 26-1040.



Installation
Check the installed position of the dust guard - it must be flush with the center mount.

Important!
Check movement of the center mount.



26 12 010



26 12 011



26 12 012



26 12 013

26 12 011 REPLACING PROPELLER SHAFT

Propeller shaft without slide on Center Mount -

Remove propeller shaft - refer to 26 11 000

Important!

The propeller shaft was balanced in an assembled state and the propeller shaft sections may not be turned when assembled. Note the paint marks.
Mark an unmarked propeller shaft

Unscrew the bolt
Pull off front section of the propeller shaft

Installation

Assemble the propeller shaft that the paint marks are aligned.
Insert the bolt with a lock washer**
Tightening torque*

Pull the center mount off together with the grooved ball bearing
Use a standard puller

Installation.
Check the installed position of the dust guard



24 1 040

Drive the center mount on to fit tight using Special Tool 24 1 040.

Important!

Check the center of the center mount

* Refer to Specifications
** Source of Supply: BMW Parts

26 13 001 REPLACING BOTH PROPELLER BUSHES/CONTENANTS Three Piece Propeller Shaft

Remove propeller shaft. Refer to 26 11 000.
 Unscrew threaded bush using Special Tool
 26 1 040.
 Put off front section of the propeller shaft.

Important!

The propeller shaft was balanced in an as-
 assembled state and may not be turned in
 position.

Note the paint marks.
 Mark unmarked propeller shaft sections.

Installation

Lubricate the slide with Molykote Longram
 3".

Install threaded bush (1), washer (2) and
 rubber ring (3).

Assemble the propeller shaft that the paint
 marks are aligned.

Note

The propeller shaft sections are mounted
 in such a manner that the universal joints
 are in one plane.

If the slide had been erroneously disas-
 sembled without marking, wrong installa-
 tion of drive shaft is possible due to the
 balancing.

Lift circlip (4) out and remove dust guard
 (2).

* Refer to Specifications

** Source of Supply: BMW Parts

Put the center mount off together with the
 grooved ball bearing.
 Use a standard puller.

26 24 001

Install dust guard (1).
 Drive the center mount on to its right using
 Special Tool 24 1 050.

26 35 004

DISMOUNT

Check the installed position of the dust
 guard — it must be flush with the center
 mount.

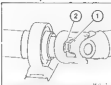
Important!

Check movement of the center mount.

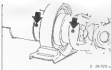
26 14

26 26 014

26 26 014



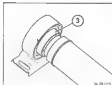
Unscrew bolt (1).
Press the universal joint off while unscrewing the bolt.
Remove washer (2).



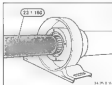
Important!
The propeller shaft was balanced in an assembled state and may not be turned in the slide.
Note the joint marks.
Mark unmarked propeller shaft sections.

Put off rear sections of the propeller shaft

Installation
Assemble the propeller shaft that the joint marks are aligned.
Install the bolt with a lock washer**
Tightening torque*

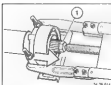


Install the center mount with a long roller (3) for the propeller shaft sections.



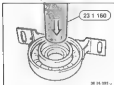
Drive the center mount on to fit tight using Special Tool (3) + 100.

Important!
Check movement of the center mount.



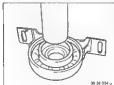
Remove the dust guard.
Screw the universal joint mounting bolt (1) in again without the washer.
Put the second center mount (3) together with the grooved ball bearing.
Use a standard puller

* Refer to Specifications.
** Source of Supply: BMW Parts.



26 12 011 REPLACING GROOVED BALL BEARING IN PROPELLER SHAFT CENTER MOUNT

Remove center mount - refer to 26 12 001 / 002
 Press the grooved ball bearing out using Special Tool 22 1 160.



Always coat the center mount in the area of the ball bearing with *Chocklight*™
 Press the ball bearing in as far as the stop using a suitable sleeve.

26 12 000 PRELOADING AND CHECKING PROPELLER SHAFT CENTER MOUNT

Refer to "Removing Propeller Shaft" in 26 11 000 for the procedures.

26 20 000 Removing and installing input shaft

- 4-wheel drive -

Caution

Do not use engine to move vehicle once input shaft has been removed

Remove all six screws

Installation instruction

Replace stop nuts.

To prevent torsion stress on the flexible coupling, only turn the nuts or bolts on the flange side, if possible.

Tightening torque 26 11 1 A2*

Slide back input shaft

Remove joint disk with centering flange

Installation instruction

Check seal, replace if necessary

Coat centering spacer with Molykote Longrun 2** grease

* Refer to Specifications

** Source of Supply: BMW Parts Service



Installation instruction

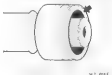
Flexible coupling must be installed that an even point is flange arms.



Remove input shaft from transfer case

Installation instruction

During installation, ensure that seating ring on the input shaft is located accurately in the dust cover



26 20 001 Removing and installing flexible coupling for input shaft.

- 4-wheel drive -

Caution!

Do not use engine to move vehicle once the joint disc has been removed.

Remove all six screws

Installation instruction

Replace stop nuts.

To prevent torsion stress on the joint disc, only tighten the nuts or screws on the flange side, if possible.

Tightening torque 26 N·m (18.7

Slide back input shaft.

Remove joint disc with separating flange.

Installation instruction

Check oil. Replace if necessary.

Coat centering spigot with Molykote Longterm 2nd grease.

Refer to Specifications

— Source of Supply: BMW Parts Service



Installation instruction

Joint disc must be installed that arrow point to flange axis.



Installation instruction

Coat sealing ring with grease.

During installation, ensure that the sealing ring on the front input shaft does not slide into the dust cover.



TROUBLESHOOTING PROPELLER SHAFT

Condition	Reason	Correction
Drumming noise in stationary car	a) Propeller shaft without influence	a) Check engine tuning, take tension out of exhaust assembly
Shaking while moving off forward/reverse (center mount knocking)	a) Propeller shaft not aligned properly b) Runout on centering pin, transmission or final drive flanges c) Center mount rubber torn, Propeller shaft axial compensator or propeller shaft with slide seized d) Universal joints worn excessively or seized e) Engine/transmission suspension not okay f) Joint disc rubber torn	a) Align propeller shaft b) Check centering pin and flanges for runout with a dial gage - see Specifications. Align or replace final drive/transmission flange c) Replace center mount - see 26 11 05 f) Align propeller shaft. Check movement of axial compensator lubricating slide with Molykote Longterm 2 if necessary and tightening the screw-on sleeve with correct torque* d) Check whether there is play or difficult movement, replacing propeller shaft if necessary - see 26 11 000 e) Check mounts, sagging or replacing if necessary f) Replace joint disc - see 26 11 05 c)
Shaking at 40 to 60 km/h (25 to 30 mph)	a) Propeller shaft not aligned properly b) Runout on centering pin, transmission or final drive flanges c) Center mount rubber torn, Propeller shaft axial compensator or propeller shaft with slide seized d) Universal joints worn excessively or seized e) Joint disc rubber torn	a) Align propeller shaft b) Check centering pin and flanges for runout with a dial gage - see Specifications. Align or replace final drive/transmission flange c) Replace center mount - see 26 11 05 f) Align propeller shaft. Check movement of axial compensator lubricating slide with Molykote Longterm 2 if necessary and tightening screw-on sleeve with correct torque* d) Check whether there is play or difficult movement, replacing propeller shaft if necessary - see 26 11 000 e) Replace joint disc - see 26 11 05 c)

* See Specifications

TROUBLESHOOTING PROPELLER SHAFT

Condition	Causes	Correction
Drumming noise from 60 km/h (37 mph) on	<p>a) Propeller shaft not aligned properly or installed with tension. Axis compensation of propeller shaft with side adjust.</p> <p>b) Centering pin damaged.</p> <p>c) Runout on centering pin, transmission or final drive flanges.</p> <p>d) Excessive centering due to excessively worn flange bones (loose mounting bolts).</p> <p>e) Excessive propeller shaft imbalance, balance plate missing.</p> <p>f) Universal joints worn excessively or seized.</p>	<p>a) Align propeller shaft. Check movement of axial compensator, lubricating the slide with Molykote Lubriplate 2 if necessary and tightening screwed-on slivers with correct torque.</p> <p>b) Replace centering pin - see 26-11 301 -</p> <p>c) Check centering pin and flanges for runout with a dial gauge - see Specifications. Align or replace final drive transmission flange.</p> <p>d) Replace transmission or final drive flange.</p> <p>e) Balance or replace propeller shaft.</p> <p>f) Check whether there is play or difficult movement, replacing propeller shaft if necessary.</p>
Low center mount noise while driving	<p>a) Center mount not perpendicular to propeller shaft - set or insufficiently preloaded.</p> <p>b) Center mount grooved ball bearing not okay.</p>	<p>a) Preload center mount in forward direction and perpendicular to propeller shaft. 4 to 6 mm (0.157 to 0.236") preload for propeller shaft with slide on center mount, without slide: 2 to 4 mm (0.079 to 0.157").</p> <p>b) Replace grooved ball bearing - see 26-12 301.</p>

* See Specifications

27 Transfer box

27 10 001	EM interlock – function check	27- 10/1
010	Transfer box – remove and install – manual transmission	27- 10/2
010	Transfer box – remove and install – automatic transmission	27- 10/5
27 21 020	Rada seal for output flange – replace	27- 21/1
030	Rada seal for output shaft on front axle – replace	27- 21/2
510	Rada seal for input shaft – replace – manual transmission	27- 21/4
510	Rada seals for input shaft – replace – automatic transmission	27- 21/5
27 70 000	Rubber mount for transmission mounting – replace	27- 70/1

27 10 001 Check function of EM interlock

The following test can be performed to obtain a 'yes' and 'status' message on the function of the EM interlock in the transfer box.

- 1 Place car on vehicle lift. All wheels clear of ground.
- 2 Apply handbrake.
- 3 Start engine and select 1st gear or Drive setting.
- 4 Depress accelerator - front wheels should turn.
- 5 Depress accelerator further until the rear wheels start to rotate despite the applied handbrake.
Caution!
Only perform test for a short period. (Rear on brake longest).
- 6 If the EM interlock is not functioning, the rear wheels do not rotate, even when an gear speed is **2nd/forward**.

27-10-010 Removing and installing transfer box:

• Manual transmission •

Removing and installing a chassis system

a Removing propeller:

Remove fast bolts plate (1).



24-17-010 E

Unscrew propeller shaft on transmission

Installation instruction:
Replace stop nuts.
Tighten screws with specified torque*



24-17-010 E

Unscrew center mount.

Installation instruction:
Center mount in forward direction A ± 4 - 5 mm.
Prelsd in forward direction.



24-17-010 E

* Refer to Specifications

Fold propeller shaft downwards and withdraw from transmission.



Caution!

Don't let the propeller shaft fall into the joints.
Suspend propeller shaft from car on a piece of wire.
Tightening torque*

b Removing transfer box

Unscrew flexible coupling between manual transmission and transfer box from output flange on manual transmission.



24-17-010 E

Installation instruction:
Replace stop nuts.
Tightening torque*

Note:

To avoid torsion stress on the flexible coupling, only if the design makes this possible - tighten nuts or screws on the flange side.

Support transmission from underside.



24-17-010 E

* Refer to Specifications

Unhook cross-member from body and transfer box and remove.
Lower transmission.

Installation instruction:
Tightening torque*

Installation instruction:
When lowering the transmission, the coolant air guide for the alternator can slip out. Check once the transmission has been in-

Turn bayonet connection for transfer box output counter-clockwise and remove.

Installation instruction:
Fit plug in such a way that marking grooves are aligned with one another.

Remove bracket for cable on transmission control unit.

* Refer to Specifications

Unhook transfer box and remove by drawing box forwards.

Installation instruction:
Tightening torque*

Caution!

The input shaft must not slip down when lifting out the transfer box since this would damage the shaft seal.

Installation instruction:
Note down screws.

Installation instruction:
Move rubber coupling into a position where the top screw is unable to slip into the housing bore.
Align manual transmission range accordingly.

* Refer to Specifications



SA 27-10/4

Installation instruction

During installation, ensure that the sealing ring on the front propeller shaft does not slip into the dust cap.



SA 27-10/4

a - Checking oil level in the transfer box

Check the oil level on the filter screen. If necessary, top up with oil to the lower edge of the filter aperture.

Installation instruction

Tightening torque*

* Refer to Specifications

** For all grades refer to Consumables Specifications

27 10 010 Removing and installing Transfer Box Automatic transmission

Remove automatic transmission complete
with transfer box 24 00 000



Position transmission vertically
Transfer box at top

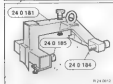
Unscrew transfer box and fill oil



Secure torque converter to prevent dropping
out



Caution!
Do not arrive automatic transmission after
removing transfer box.
The clutch disk can slip out making it necessary
to disassemble the entire transmission.
If necessary in holder refer to 24 12 010



Secure transmission with special tool 24 0 181
in conjunction with adapter 24 0 185 and
24 0 184 and mount on assembly rig 24 0 180.



The spacer ring must be determined when if
the automatic transmission of transfer box is
to be repaired or other jobs are to be carried
out which influence the thickness of the
spacer ring.

- 1) Spacer ring
- 2) Needle thrust bearing



Drain oil from transfer box

Installation note
For tightening torque 27 06 T42

* Refer to Technical Data

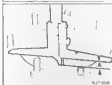


a Determining thickness of shim

Place existing shim with pressure bearing in automatic transmission.

Determine dimension (A) on automatic transfer design between contact face and pressure bearing.

Example Dimension A = 15.1



Place transfer box upright.

Determine dimension (B) on transfer box between contact face for support face for pressure bearing.

Example Dimension B = 12.5

Example:

$A = 15.1 \text{ mm}$
 shaft... $B = 12.5 \text{ mm}$
 End Foot $= 0.5 \text{ mm}$

Required end Foot = $0.1 - 0.5 \text{ mm}$.
 Install correspondingly thicker or thinner shim.



Selection: Dimension A greater than dimension B = thinner disk.
 Dimension A larger than dimension B = thicker disk.

a Fitting transfer box

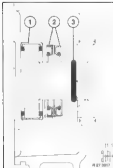
Replace O-ring on transfer box and coat with vaseline.



Caution!
 An O-ring is located on the transmission shaft.

Check: replace O-ring and coat with Vaseline.





Arrangement

- 1 Bearing
- 2 Radial seal
- 3 Cotter



Attach shim and axial bearing with Vessel

Carefully fit transfer box and tighten down

Tightening torque 27.05 N.m

Caution!
Note down alarm



Refer to Specifications



Place plastic cap on the nut shown in the illustration.
(Protection for Bowden cable).

After installation in the vehicle, top up oil** in the transfer box

Correct oil level in automatic transmission



** Oil grade: refer to Consumables Specifications

27 21 020 Replacing radial seal on output flange

Remove propeller shaft from transfer box, see 26 11 000



Fit each special tool 23 1 300.
Hold output flange with special tool 33 0 000.
Unscrew collar nut with special tool 23 1 210.

Pull off output flange



Remove radial seal with special tool 00 5 010



Coat new radial seal with oil and insert with special tool 27 1 320

Sealing lip faces housing



Insert output flange to 80 °C and slide spline onto output shaft



Fit screwlocking device** to thread and collar of collar nut

Secure on collar nut.
Tightening torque 27 00 042*

Check oil level in transfer box

Check oil level on filler screw.
If necessary, fill with oil*** to lower edge of filler aperture.

Tightening torque 27 00 1A2*

* Refer to Specifications
* Source of Supply: BMW Parts Service
*** Oil grade: refer to Consumables Specifications



27 21 020 Replacing radial seal for output shaft on front axle

Removing and installing exhaust system, see 18 00 020

Remove propeller shaft from back of transfer box, see 26 11 020

Removing and installing propeller shaft from front, see 26 20 020

a Work on the automatic transmission.

Unplug clips.
Remove Bowden cable

Unscrew nut for Bowden cable cables

Detach Bowden cable sleeve from bracket

b Lowering transfer box

Support transmission on the converter ball housing.

Unscrew cross-member from body and transfer box and remove
Lower transmission

Installation instruction:
Tightening torque 27 00 042*

Installation instruction:
When lowering the transmission, the control air guide for the alternator can slip out.
Check once the transmission has been installed.

Press off protective cap.

* Refer to Specifications



27 21 042



27 042



27 0001



27 020



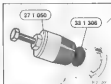
27 020



27 011



27 012



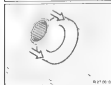
Lift out radial seal with special tool 27 1 305 in conjunction with 27 1 306.



Fit special tool 27 1 311



Coat radial seal with grease and drive in with special tool 27 1 312.



Press on protective cap



- 1 Check oil level in transfer box
 - 2 Check oil level on the filter carrier. If necessary, fill with oil*** to lower edge of filter aperture
 - 3 disassembly instruction
- Tightening torque 27-00 14.2*

* Refer to Specifications
*** Oil grade: refer to Construction Specifications

27 21 510 Replacing radial seal for input shaft Manual transmission

Remove transfer box 27 10-010

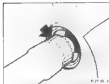
Remove input shaft



Left out radial seal



Coat new radial seal with grease and drive in to place with seating lip facing inside, using special tool 27 1-290



Carefully insert input shaft.
(Damage to radial seal)



Prevent input shaft from falling out
if necessary, use blocker from replacement
transmission

o Checking oil level in transfer box

After installation, check oil level on filler
screw

If necessary fill with oil*** to lower edge of filler
aperture

Installation instructions:
Tightening torque 27 05 FA.2



* Refer to Specifications

*** Oil grade: refer to Consumables Specification

27 21 510 Replacing radial seals for input shaft

Automatic transmission

Remove transfer box 27 10 010

Note:

The radial seals are located behind the roller bearing.

a Removing roller bearing.

Turn back spindle from special tool 27 1 330 as far as possible.

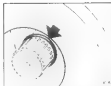
Rotate slide in circular direction.
Insert special tool.

Turn slide until aligned with marking.
Slide now grips behind the roller ring.

Remove roller bearing.

b Replacing radial seals

Lift out radial seals (2 nr) with special tool 00 5 810.



Note:

An O-ring is located on the transmission shaft.

Check O-ring, replacing if necessary, and coat with grease.



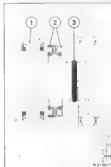
Coat smaller radial seal with oil and install with sliding up facing forwards.

Coat larger radial seal with oil and install with sealing lip facing outwards.

Drive in both radial seals with special tool 27 1 290.

Arrangement

- 1 Bearing
- 2 Radial seals
- 3 O-ring





- * Drive in new roller bearing with special tool 27 1 300.



g Checking oil level in transfer box

After installation, check oil level on the filler screw.
If necessary, fill with oil** to lower edge of the filler aperture.

Installation instructions
Tightening torque 27 50 T42*

* Refer to Specifications
** Oil grade: refer to Consumables Specification

27 70 000 Replacing rubber mount for transmission mount

Manual transmission
Removal and installing exhaust system,
[]

Automatic transmission

Remove transfer box 27 10 015



Remove fast fasteners plate



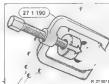
Support transmission on the converter bell housing.



Uninstall cross-member from body and transfer box and remove, lower transmission

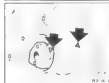
Installation instruction
Tightening torque 27 00 0A2

* Refer to Specifications



c Replacing rubber mount.

Fit special tool 27 1 190.
Press rubber mount out forwards



Fit new rubber mount.
The arrow on the housing must be aligned with the marking (arrow) on the rubber mount.
The protruding side of the internal bush points in reverse direction of travel (i.e. backwards).



Press outer mount flash with transmission housing with special tool 27 1 190.

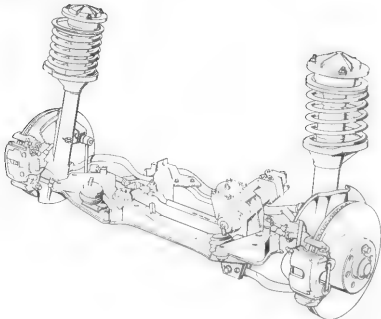
31 Front axle

	Front wheel suspension – layout drawing	31-	0/1
	Struts and arms – layout drawing	31	0/2
31 10 000	Front axle assembly – remove and install	31-	10/1
31 11 001	Front axle carrier – replace	31-	11/1
31 12 000	Control arm, left or right – remove and install	31	12/1
090	Thrust strut, left or right – remove and install or replace	31-	12/2
130	Rubber mount in left or right control arm – replace	31-	12/3
	Thrust strut mounts – check	31-	12/4
147	Rubber mount in left or right thrust strut – replace	31-	12/5
31 21 180	Bearings (wheel hub) for front wheel – replace	31-	21/1
31 31 000	Front spring strut, left or right – remove and install	31-	31/1
031	Front spring strut, left or right – replace	31-	31/2
	Shock absorber with mount and coil spring – layout drawing	31-	32/1
31 32 001	Shock absorber for left or right front spring strut – replace	31-	32/3
31 33 001	Mount for left or right front spring strut – replace	31-	33/1
100	Coil spring for left or right front spring strut – remove and install or replace	31-	33/1
	Car ride level, height – measure and correct (before 1992 models)	31-	33/2
	Car ride level, height – measure and correct (since 1992 models)	31-	33/5
31 35 000	Front stabilizer – remove and install or replace	31-	35/1
	Front axle – troubleshoot	31-	90/1
	Shock absorbers – troubleshoot	31-	90/3

Four wheel drive

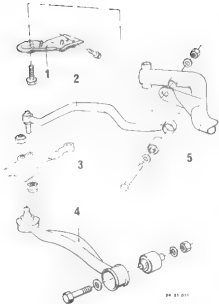
	Front wheel suspension layout drawing	31-	0/10
31 10 000	Front axle assembly – remove and install	31-	10/10
31 11 001	Front axle carrier – replace	31-	11/10
31 12 000	Control arm, left or right – remove and install	31-	12/10
046	Control arm bracket – replace	31-	12/11
130	Control arm rubber mount – replace	31-	12/13
31 21 090	Pivot bearing, left or right – replace	31-	21/10
121	Wheel hub (drive flange), left or right – replace	31-	21/11
151	Bearings of wheel hub (drive flange), left or right – replace	31-	21/12
	Spring strut assembly layout drawing	31-	31/10
31 31 031	Front spring strut shock absorber, left or right – replace	31-	31/11
31 33 001	Front spring strut mount, left or right – replace	31-	33/10
100	Front spring strut coil spring, left or right – replace	31-	33/10
	Car ride level, height – measure and correct	31-	33/11
31 35 000	Front stabilizer – remove and install	31-	35/10
31 50 000	Front axle differential – remove and install or replace	31-	50/10
31 51 015	Shaft seal for left output shaft – replace	31-	51/10
020	Shaft seal for right output shaft – replace	31-	51/10
060	O-ring for right front axle differential – replace	31-	51/11
065	O-ring for right mounting block – replace	31-	51/11
31 53 050	Bearing (in bearing block) for right output shaft – replace	31-	53/10
31 60 000	Output shaft, left or right – remove and install or replace	31-	60/10
	Front axle – troubleshoot	31-	90/10
	Shock absorber – troubleshoot	31-	90/12

FRONT AXLE LAYOUT DRAWING



LAYOUT DRAWING OF STRUTS AND ARMS

- 1 Support
- 2 Thrust strut
- 3 Tie rod arm
- 4 Control arm
- 5 Connecting pipe



31 10 000 Removing and installing complete front axle assembly

Remove brake caliper (lines remain connected), refer to Group 34
Remove ABS pulse generator refer to Group 34
Observe EDC notes, Group 37

Note
Align front axle after mounting refer to Group 37

Attach engine to tool 80 0 200
Use chain and shackle of tool 31 0 000
Depending on engine, also refer to Removing engine 11 00 000

Release nut
Using tool 32 0 040, press the rod from pitman arm.

Installation note
Replace self-locking nut
For tightening torque*

Release steering gear retaining bolts (1 and 2)
Tie back steering gear. Lines remain connected.

Installation note

- 1 Bolt
- 2 Bolt, only install strength class 10.9
- 3 Shim
- 4 Bush
- 5 Replace nuts

For tightening torque*



31 20 040



31 31 040



31 31 040

Release bolts on left and right

For tightening torque, refer to Technical Data



31 31 040

Release engine mount on left and right of front axle carrier
Also release right-hand engine mount at top.

For tightening torque*

* Refer to Technical Data



1. Lift off cap
 2. Unscrew nuts on left and right sides
 3. Annotate
 4. Replace self-clocking nuts
 5. Tightening torque*



Place workshop park underneath the front
 as a safety
 1. Unscrew bolts on left and right sides and
 cover the front axle housing
 2. Important!
 3. Spring struts must not lift out or down
 4. This would damage the tie joints
 5. Installation
 6. Tightening torque*

31 11 001 Replacing front axle carrier

Note

The pinion arm must be adjusted after installing a new front axle carrier: refer to Group 31 11 010.

Align front axle after assembly, refer to Group 32.

Attach engine to special tool 30 0 260.
Use chains and shackles from tool 31 0 020.
Depending on type of engine, also refer
Removing Engine 11 00 060.

Release engine mount on left and right of front
[] right-hand engine mount at top.

Installation note:
For tightening torque*

Remove left and right control arms

Installation note:
Replace self-locking nuts.
For tightening torque*, in normal position*

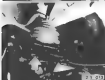
* Refer to Technical Data



Release steering gear retaining bolts (1 and 2).
Tighten steering gear - Axle remains corner-
[]

- 1 Bolt
- 2 Bolt, only fit strength class 10.9
- 3 Washer
- 4 Bush
- 5 Replace nuts

For tightening torque*



Remove idler arm

Replace self-locking nut
For tightening torque*
1 Bolt
2 []
3 []
4 Self-locking nut
5 Front axle carrier



Release bolts on left and right and remove
front axle carrier

For tightening torque*

* Refer to Technical Data

31 12 000 REMOVING AND INSTALLING LEFT OR RIGHT CONTROL

Remove front wheel - see Group 38

Unscrew bolts

Installation

Clear threads of bones and bolts

Install bolts with a lock washer**

Tightening torque*

Check for correct installed position.

Unscrew nut

Press off ball joint with Special Tool

31 1 110

Installation

Remove grease on ball pin and in bore

Replace self-locking nut

Tightening torque*

* See Specifications

** Source of Supply 14990

Unscrew bolt

Installation

Replace self-locking nut

Tightening torque*

* Tightening torque* for car loaded alone to nominal position*

* See Specifications

31 12 090 REMOVING AND INSTALLING OR REPLACING LEFT OR RIGHT THRUST STRUT

Remove front wheel - see Group 36.



Unscrew nut
Pry off ball joint with Special Tool
31 2 140.

Installation:
Keep grease off of ball joints and
bore.
Replace self-locking nut
Tightening torque*

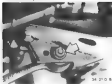


Unscrew thrust strut (counterhold with
open-ended wrench), grinding off if
necessary

Installation:
Replace self-locking nut
Use washers on both sides.
Tightening torque* for car loaded down
to normal position*

Important:
Thrust strut mounts must always be
installed or replaced in pairs

* See Specifications

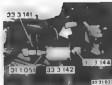


21 12 130 REPLACING RUBBER MOUNT IN LEFT OR RIGHT CONTROL ARM

Uncrew control arm.
Aluminum control arms must always be replaced.

Installation

Replace self-locking nut.
Use washers on both sides.
Tightening torque* for car loaded down to normal position*



Suspend control arm from car on a piece of wire (prevents damaging the ball joint).

Pull out rubber mount with Special Tools 31 1 051 and 31 3 141-142-144.

Installation

Remove grease from rubber mount and control arm bones.

Push in rubber mount from the bevelled side of the control arm.
Same tools as above.



Remove Control Arm.

Press rubber mount out and in on a press and with Special Tools 31 1 051-052 as well as a pressure pad.

* See Specifications



31-12/4-1

31-12 CHECKING THRUST STRUT MOUNTS

Load the car down to normal position.
Measure distance (A) between the rubber part and centering sleeve, using a feeler gauge blade.

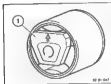
Specification
A = 1.0 to 2.0 mm

If there is deviation from the specification, the mounts must be replaced - refer to 31-12-149

Important!
Thrust strut mount(s) must always be installed or replaced in pairs



31-12/4-2



31-12/4-3

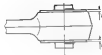
Note
The hydraulic pressure strut mounts, which can be recognized on the plastic clip (1), cannot be checked.
Both mounts must be replaced. If fluid is running out of a hydraulic mount

31 12 147 REPLACING RUBBER MOUNTS IN LEFT OR RIGHT THRU-STRUT

Remove thru-strut - refer to 31 12 095

Important

Thru-strut mounts must always be installed or replaced in pairs.



1 2 3

Installation

8 mm equal amount of pressure (10 on 1000000)



Press the rubber mount out in a press using Special Tools 31 1 052 - 053 and thru-press (1)



31 12 147

Important

Rubber mount and thru-strut bore must be free of grease.

The arrow on the rubber mount points to the mark on the thru-strut.

Hydraulic Mounts

The arrow on plastic clip (1) points to the mark on the thru-strut.

The special tool must bear on the outer sleeve of the mount when pressing the mount in.



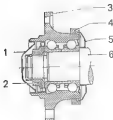
31 12 147

31 21 180 REPLACING BEARINGS (WHEEL HUB) FOR FRONT

Important!

Do not reuse the bearing unit after removal.
Unscrew fork's disc. Line remains connected
(see Group 34)

Wheel Bearing



1 3 000

- 1 Grease cap
- 2 Collar nut
- 3 Bearing unit

- 4 Pulser gear
- 5 Dust cover
- 6 Shaft seal



Pry off grease cap with a screwdriver.
Do not reuse the cap!



Chisel off lock of collar nut.
Unscrew nut with Special Tool 31 2 080.
Do not reuse the nut!



Pull off bearing unit with Special Tools
31 2 102/105/106 and wheel bolts (1).
Do not reuse the bearing unit!

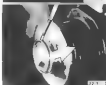


After Bearing Inner Race Remains on Shaft
Aids
Insert wooden wrench key and unscrew guard.



Screw on new collar nut with correct tightening torque** and lock by pinching.

Pull off bearing inner race and dust cover with Special Tools 31 2 100-102



Install new cap with a sealing compound**



Screw on guard (1)
Install new dust cover (2)
Screw on Special Tool 31 2 110 whole length of threads.



Slide and pull on new bearing unit with Special Tool 31 2 110

* See Specifications

** Source of Supply HWS

31 31 000 REMOVING AND INSTALLING LEFT OR RIGHT FRONT SPRING STRUT ASSEMBLY

Unscrew brake caliper (line remains connected)* see Group 34
Remove ABS pulse sensor** see Group 34
Refer to 8.0G instructions in Group 37



Lift off cap
Support spring strut
Unscrew spring strut mount on wheel hub
Installation
Replace self locking nuts
Tightening torque*



Unscrew stabilizer push rod, cushion holding with an open ended wrench
Installation
Wrench surface on ball joint protected by the absorber axle
Replace self locking nut
Tightening torque*

Unscrew bolts
Installation
Clean threads of bore and bolts
Install bolts with a lock washer**
Tightening torque*

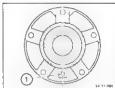
Check for correct installed position.

* See Specifications
** Source of Supply: HVB

Important!!
Always store shock absorbers standing upright
If shock absorbers are stored lying down with piston rods run in, they could cause a rattling noise when used again
Correction
Store shock absorbers standing upright with piston rods run out at room temperature for 24 hours.



* See Specifications



31 34 001 REPLACING LEFT OR RIGHT RIGHT SPRING STRUT

Remove spring strut - refer to 31 31 000.
Remove shock absorber for spring strut -
refer to 31 30 000.
Replace wheel bearings - refer to 31 32 107.

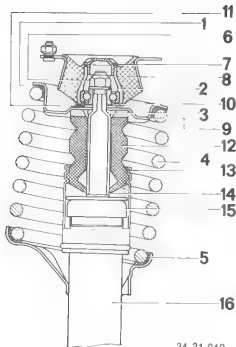
Important

On cars which had been produced prior to
introduction of the standard wheel bearing,
parts as shown on the parts map(s) be-
must be replaced in addition to the spring
strut.

The standard wheel bearing can be recog-
nized as being (1) provided in the middle
of brake disc installation.

Spring Strut Assembly Drawing - 620 -

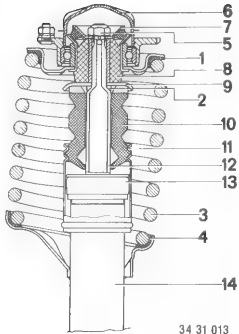
- 1 Spring retainer - upper
- 2 Washer
- 3 Ring for hollow piston rod
- 4 Coil spring
- 5 Spring retainer - lower
- 6 Nut
- 7 Cap
- 8 Mount
- 9 Spring retainer - upper
- 10 Seal
- 11 Washer
- 12 Rubber damper
- 13 Protection pipe
- 14 Shock absorber
- 15 Bumper on ring
- 16 Spring strut



LAYOUT DRAWING OF SHOCK ABSORBER WITH MOUNT FOR SEPARATE SUSPENSION AND COIL SPRING

Model: S2442 M2 (After Conversion of Standard Spring Strut)

- 1 Upper spring ring
- 2 Ring for narrow piston rod
- 3 Coil spring
- 4 Lower spring ring
- 5 Nut
- 6 Cap
- 7 Drop washer
- 8 Mount
- 9 Support
- 10 Protective plate
- 11 Shock absorber
- 12 Screw-on ring
- 13 Spring strut



31 32 001 Replacing shock absorber for front left or right spring strut

To know whether a spring strut shock absorber has to be replaced, it must either be checked installed with a Shock Tester or removed and checked in a shock absorber testing machine.
Also refer to Service Information 31 31 90 (887).



Unscrew self-locking nut with tool 31 3 170/210 (replace socket), brace piston rod

Installation

Replace self-locking nut, tightening torque*



Remove complete spring strut - 31 31 000 and clamp in vice with tool 31 3 500.



Press together coil spring using spring tensioner 31 3 121/122.

Caution!

The tool must grip 3 spring coils.



Installation

Installation sequence, refer to "arrangement of shock absorber"

Check top and bottom base spring mount and replace if necessary.
The ends of the coil springs must locate in the recesses in the top and bottom spring plate.

Unscrew screw-on ring with Special Tool 31 3 150

Installation
Tightening torque*



31 3 150

Important:
The M 5 is delivered as factory with "wet spring struts". If they are at it required, it is always necessary to replace both shock absorbers.
Take off rubber cover.
Pull off retainer stop shell – don't
=====



32 31 043

Unscrew screw-on ring slowly with Special Tool 31 3 180 (to let pressure escape if the absorber).

Installation
Replace screw-on ring
Tightening torque*



32 31 044



31 3 180

Pull out shock absorber (1)

Installation
Remove old oil from spring strut pipe (2).
Fill with engine oil** prior to installation of new shock absorber.
Engine oil is required to carry off heat from the shock absorber to the spring strut pipe.

Important!
Single-pipe gas pressure front axle cartridges, recognized on piston rod diameter > at least 25 mm (1.590"), may not be treated with oil – see Service Information of Group 31.
Only store shock absorbers standing upright. If shock absorbers are stored laying down with their piston rods up in, this could cause a rattling noise when used in car again.
Correction:
Store shock absorbers standing upright with piston rods up at room temperature for 24 hours.

31 32 001 REPLACING MOUNT FOR LEFT OR RIGHT FRONT SPRING STRUT

Procedures are identical with those for
replacing shock absorber see 31 32 001

Important!

If the installed mount is marked with "1" or
"2" a mount with the same mark must be
installed.

Also refer to correcting chamber in Group 32



32 31 919

31 32 100 REMOVING AND INSTALLING OR REPLACING COIL SPRING FOR LEFT OR RIGHT FRONT SPRING STRUT

Procedures are identical with those for
replacing shock absorber see 31 32 001

Important!

Only install pairs of springs on one axle with
the same BMW number (1) located on end
of spring.

Refer to parts catalogue for cross reference
of springs to vehicle type and, if applicable,
special equipment (e.g. air conditioner, sport
equipment, etc.) as well as date of introduc-
tion.

The BMW number on the spring can be used
to determine the part number and therefore
the correct spring for a particular vehicle type
according to the parts catalogue.



31 32 104



31 33 MEASURED - CORRECTING RIDE LEVEL HEIGHT BEFORE RHD MODELS

Load down car to normal position*

Measure actual height in (A) from wheel house lower edge (1) to rim range (2) at center of wheel height. Determine the mean value of each wheel after filling and lowering the car body, and then the mean value of the axle.

Determine any deviation from the nominal ride level height value*

Identify the installed springs - refer to 31 33 100.

Find correction spring in the table. The numbers are ride level height deviation (nominal values in mm) between the permanent springs.

Example:

The car is supplied with coil springs having BMW No. 1 133 333 and is, for example, 8 mm too deep due to so many optional extra equipment items. The nominal ride level height* is reached again by installing springs having BMW No. 1 133 334 (refer to 31 33 100 for information on determining part numbers).

Note:

Additional ride level height correction by installing spring rings of different thickness is not possible.

Table for Standard Suspension - 320

- A = Equipment after correction
B = Equipment of delivered car
a = Adjusted higher
b = Adjusted lower

		A									
B		a		+30 -6	+15 -2	+15 -3	+15 -4				
		b									
	1 135 040				-6	+13	+20				
	1 135 442				-6		+16				
	1 135 443				-7	-6		+7			
	1 135 444					-6	+7				

T **E** **R** **M**

Address for pages 391-392: Not a placeholder in

Abstract See pages 294–295. **Not explained**

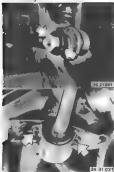


31-33 MEASURING CORRECTING RIDE LEVEL HEIGHT SPACE TRIP MODEL 5

Load down car to normal position*

Measure actual height (A) from wheel lowest down edge (1) to rim flange (2) at corner of wheel height. Determine the mean value of each wheel after lifting and lowering the car body and then the mean value of the axle.

In case of deviation from the nominal value*, install ring coil springs refer to parts catalogue for information on determining correct coil springs.



31 35 000 REMOVING AND INSTALLING OR REPLACING FRONT STABILIZER

Unscrew each nut on left and right sides
Remove nuts

Breakish surface on ball pin is parallel to the
absorber arm

Replace self locking nut

Tightening torque *

Unscrew nuts on left and right sides

Take off the stabilizer

TROUBLESHOOTING FRONT AXLE

Condition	Cause	Correction
Grinding noise (brake) is heard	a) Wheel bearings defect etc.	a) Replace wheel bearings
Vibration	a) Imbalance of wheels b) Run lateral and radial runout c) Tire radial runout	a) Balance wheels b) Replace tires, if necessary c) Match or replace tires
Steering wheel shake	a) Run lateral and radial runout b) Imbalance of wheels c) Shock absorber effect insufficient d) Thrust strut mounting defective e) Wrong thrust strut mounts installed f) Steering gear play excessive	a) Replace tires, if necessary b) Balance wheels c) Replace shock absorbers d) Replace thrust strut mounts e) Replace thrust strut mounts f) Adjust propeller point
Rolling noise	a) Shock absorber cartridge or spring strut loose b) Ball joint on control arm worn c) Ball joint on thrust strut worn d) Stabilizer rubber mounts worn e) Ball joints of push rod worn f) Front axle carrier mounted loose on body	a) Tighten parts on spring (check shackle) b) Replace control arm c) Replace thrust strut d) Replace rubber mounts e) Replace push rod f) Tighten (check threads)

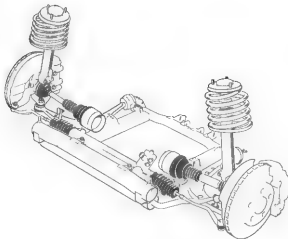
TROUBLESHOOTING FRONT AXLE

Condition	Cause	Correction
Body swing long time after driving over rough road	Weak shock absorbers (see page 31-90/3)	Replace shock absorbers
Body trip when driving over successive rough road surfaces		
Body roll while accelerating		
Wheel jump over or overhit road surfaces		
Car braking out while braking		
Braking out (skidding) in curve due to poor track holding		

TROUBLESHOOTING SHOCK ABSORBERS

The condition of shock absorbers can only be checked with a shock absorber tester or can be with a shock absorber testing machine after removal.
 Cars with EDC (Electronic Absorber Control) See Group 37

Condition	Cause	Correction
Shock absorbers knocking (bottoming)	a) Rubber damper defect or b) Worn shock absorbers	a) Check or replace rubber damper b) Replace shock absorbers
Shock absorber noise	a) Shock absorber cartridge loose b) Installed shock absorber had been stored lying down with piston rod run in c) Shock absorbers defect or	a) Tighten screw-on ring - adjust threads b) Store shock absorber standing upright with piston rod run out until room temperature has 24 hours c) Replace shock absorbers
Poor handling	a) Worn shock absorbers	a) Replace shock absorbers
Fast spots on tire treads	a) Shock absorbers defective	a) Replace shock absorbers



31 10 000 REMOVING AND INSTALLING COMPLETE FRONT AXLE

Important!

Check the wheel alignment after installation
- refer to Group 32

Unscrew covers of front wheel's
Unscrew left and right collar nuts.

Installation

Replace the collar nuts.
"tightening torque"
Lock the collars of the nuts in both grooves
of the shaft with a punch

Remove the front wheels - refer to Gr. 30
Unscrew left and right brake calipers and
suspend them from the body on pieces of
wire - refer to Group 34
Disconnect the ABS wire plug.
Loosen wires secured to the spring strut.
Remove the stabilizer - refer to 31 35 000

Unscrew nut (1) on left and right sides

Installation

Replace the self-locking nut
Install washer (2)
"tightening torque"

* Refer to Specifications



Press the tie rod off using Special Tool
32 3 000



Unscrew the nuts and pull the bolts out

Installation
"tightening torque"



If applicable, unscrew the holder for oil
pipes.



Attach Special Tool 05 0 900 to the engine.
The supports bear on the side panel bolts.

* Refer to Specifications





Unscrew bolts (1) on left and right hand sides

Insertion
Line washer (2)
Tightening torque*



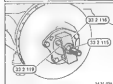
Unscrew bolts (1) on left and right hand sides

Put control arms aside and secure them on spring strut with a piece of wire so that the ball joint on the spring strut cannot be damaged

Installation
Line washer (2) on the forward ball
Tightening torque*



Ball on Special Tools 33 2 111, 33 2 116 and 33 2 117 with three wheel bolts
Press output shaft out of drive flange on left and right hand sides



Installation
Ball on Special Tools 33 2 116, 33 2 118 and 33 2 119 with three wheel bolts.
Pull output shaft into drive flange

* Refer to Specifications



Slide Special Tool 31 5 116 into gap between cage and output shaft
Pry out left and right output shafts with a jack and remove them

Installation
Replace o-rings of output shafts.
Centrize of output shafts must be heard to engage in the front axle final drive



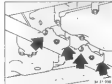
Support spring struts on left and right hand sides, unscrew nuts and remove spring struts

Installation
Tightening torque*



Unscrew nut on left and right hand sides

Installation
Tightening torque*



Unscrew bolts

* Refer to Specifications

31-10/12



Support the front axle center
Unscrew the bolt on left and right sides.

Installation
Tightening torque:



Unscrew bolts.
Remove the front axle center towards the front.

Installation
Tightening torque:
Remove and install front shield

31 11 001 REPLACING FRONT AXLE CARRIER

Important!

After installation

Check output shafts for correct engagement in input shaft final drive.

Check wheel alignment. refer to Gr 30.

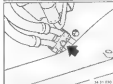
Remove stabilizer. refer to 31 30 000.



Unscrew nuts and pull out bolts.

Installation

Tightening torque:



If applicable, unscrew holder for oil pipes.



Attach Special Tool 90 0 200 on engine Supports bear on side panel screws.

Refer to Specifications



Unscrew bolts (1) on left and right hand sides.

Use washers (2) Tightening torque:



Unscrew bolts (1) on left and right hand sides.

Pull control arms aside and secure them on spring strut with a piece of wire so that the ball joint on the spring strut cannot be damaged.

ing Unit

Use washer (2) on the forward bolt. Tightening torque:



Unscrew nut on left and right hand sides.

Installation

Tightening torque:



Unscrew bolts

Refer to Specifications

31-11/11



Support the front axle carrier
Unscrew the bolt on left and right sides.

Installation
Tightening torque*



Unscrew bolts
Remove the front axle carrier towards the front.

Installation
Tightening torque*
Remove and install heat shield.

**31 12 000 REMOVING AND INSTALLING
LEFT OR RIGHT CONTROL
ARM***

Remove output shaft - refer to 31 60 000.



Unscrew nut

Installation

Replace the self-locking nut
Tightening torque*



Press the control arm off using Special
Tool 31 2 180



If applicable, unscrew the nut
Press the ball joint off of the control arm
using Special Tool 32 2 040

Installation

Replace the self-locking nut
Tightening torque*

* Refer to Specifications



31 12 101 REPLACING HOLDER FOR CONTROL ARM

Important!
After installation,
check output shafts for correct engagement
to input shaft that drives

Unscrew bolts (1).

Installation
Use washers (2).
Tightening torque*

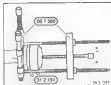


Unscrew bolts (1).
Pull control arm aside and secure it on
spring arm with a piece of wire so that the
ball joint on the spring arm cannot be
damaged.

Installation
Use washer (2) on the forward bolt.
Tightening torque*



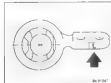
Punch marks center of control arm



Pull holder off of control arm using Special
Tools 31 2 101 and 00 7 500



Important!
A rubber mount pulled off of control arm
must never be reused, as the rubberized
interior sleeve will be destroyed by pulling
off dry.
Replace rubber mount - refer to 31 12 105.
Always replace left and right rubber mounts
and use rubber mounts of same make
(appears on mount).

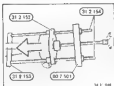


Grease control arm journal with approved
lubricant*

Installation
Holders are fitted with:
L for left holder or
R for right holder.
Centering bolts (larger diameter) are
down.

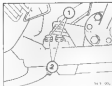
* Refer to Specifications

* Refer to Specifications
** Source of Supply: Mafin Parts

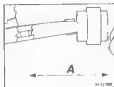


Attach Special Tool 31 2 153 in the base of the control arm.
Push the bracket/mount onto the control arm using Special Tools 31 2 153, 154 and 30 7 501.

Tip:
If the threaded rods are too short, the mount must be pulled on with the help of a puller.
After the mount has been pulled on approximately 10 mm, Special Tool 30 7 501 can be used again.



Important!
Bolt the bracket to the front axle carrier immediately.
"Tightening torque"
Load the car down to normal position immediately.
Leave the car in normal position at least 30 minutes and avoid bottoming of the suspension.
The lubricant will have evaporated after about 30 minutes and the control arm will fit tight and be correctly positioned in the rubber mount.
Non-compliance with these procedures will lead to serious impairment of handling behavior.



Pull the bracket/mount on up to distance A.
The mount must be free of tension when measuring the distance - loosen the special tool.
Measure distance A at the bottom of the control arm from a perpendicular line of the mount eye to the edge of the machined bore in the control arm.

$A = 170.3 \pm 0.3 \text{ mm}$

31-12/13

31 12 130 REPLACING RUBBER MOUNTS

PREPARATION: 310

Important:

Always replace the left and right rubber mounts and use rubber mounts of the same size (identification on mounts).

Remove bracket for control arm: refer to 31 13 048.
Press rubber mount out of the bracket using Special Tools 31 2 131¹ - 132.

Installation:

Check the installed position:
Mark (1) on the rubber mount must be aligned with mark (2) on the bracket.
The bracket and rubber mount must be free of grease.

Apply the rubber mount at the specified side of the bracket and press it in to distance (A) using Special Tools 31 2 131 - 132.

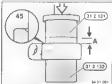
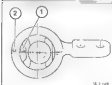
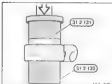
$A = 18 \pm 0.2 \text{ mm}$

Important:

Larger protrusion (B) of the rubber mount must be on the side of the bracket with the larger diameter centering bore.

$A = 18 \pm 0.2 \text{ mm}$

¹ Refer to Specifications



31 21 090 Replacing left or right axial bearing

Caution

After assembly:

Check that output shafts are correctly located in front axle differential.

Remove wheel hub (driver) (range 31 21 121).

Remove ABS impulse sensor.



31 21 090

Remove shaft.

Do not remove the bearing because a new bearing has to be installed.

Install bearing in wheel hub 31 21 101



31 21 101

Unloosen nut

Installation instruction

Replace self-locking nut.

Tightening torque 31 12 342*



31 21 101

Unloosen nut (1).

Installation instruction

Replace self-locking nut.

Install washer (2).

Tightening torque 32 21 342*



31 21 101

Press control arm off axial bearing with special tool 31 2 190



31 21 101

Press off track rod with special tool 32 3 090.

Installation instruction

Remove grease from pin and bore.



31 21 101

Knock dust cover sleeve (1) off axial bearing. Remove protective plate (2).

Installation instruction

If necessary, replace dust cover sleeve (1).

* Refer to Specifications

* Refer to Specifications



Unscrew and remove screw (1).

Installation instruction:

Install washer (2).

Screw (1) must make positive contact with the retaining web (3).

Tightening torque 31-21 34.2*



Use hammer to knock wheel bearing off spring strut.

31-21 121 Replacing left or right wheel) hub (driver flange)

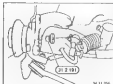
The work is identical to Replacing Bearing on Wheel Hub 31-21 101

Caution:

When the driver flange is removed, the wheel bearing is destroyed. It is always necessary to fit a new one.

31 21 184 REPLACEMENT OF LEFT OR RIGHT WHEEL HUB FORNVE FLANGE)

Remove output shaft - refer to 31 90 000
Remove brake disk - refer to Group 34



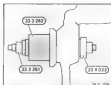
Secure the control arm to the front axle carrier with one bolt
Apply Special Tool 31 2 191



Attach Special Tool 31 2 190 on the tie rod arm and bolt it at the brake caliper mounting points.
Press the drive flange out
Remove the special tool.



Remove the circlip.



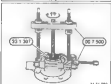
Pull the bearing out using Special Tools 33 2 261, 33 2 260 and 33 4 003.



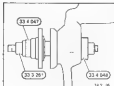
Pull a new bearing in using Special Tools 33 2 261 and 33 4 003, 347



Install the circlip

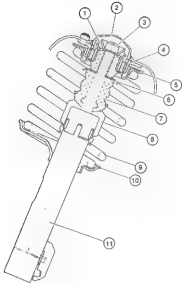


Pull the bearing inner race off of the drive flange using Special Tools 33 2 260 and 33 4 003

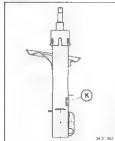


Pull the drive flange in using Special Tools
 33 3 261 and 33 4 048 - 048
 Install the output shaft and brake slip.

SPRING STRUT ASSEMBLY DRAWING



- 1 Stop washer
- 2 Cap
- 3 Nut
- 4 Mount
- 5 Spring retainer upper
- 6 Washer
- 7 Rubber mount
- 8 Bolts
- 9 Coil spring
- 10 Spring retainer lower
- 11 Spring strut shock absorber



31 31 021 Replacing left or right front spring strut shock absorber

To know whether a spring strut shock absorber has to be replaced, it must either be checked installed with a Shock Tester or removed and checked in a shock absorber testing machine.
Also refer to Service Information 31 04 02 (S&S).

When replacing a spring strut shock absorber always ensure that the replacement unit is marked with the same code (K) as the old shock absorber.

Remove front wheel, see 30 10 000
Remove stabilizer bar, see 31 30 000
Remove brake caliper and tie up, (do not sever brake line), refer to 34 01 018.

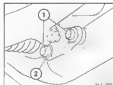
Caution!
After assembly
Check that output shafts are correctly located in front axle differential.

Unscrew nuts (1).

Installation:
Replace self locking nut
Install washer (2).
Tightening torque 32 21 342°

Press off lock rod with special tool 32 3 090

* Refer to Technical Data



Unscrew bolts (1).

Installation:
Fit washer (2) to the front screw.
Tightening torque 31 10 042°



Unfasten and remove screw (1).

Install washer (2).
Screw (1) must locate in bore of retaining web (3).
Tightening torque 31 20 042°



Support entire bearing.
Use a plastic hammer to knock the entire bearing off the spring strut.
To prevent damage to the propeller shaft, lower the control bearing until the spring strut is freely accessible.



Unscrew nuts and remove spring strut.

Installation:
Tightening torque 31 1 142°

* Refer to Technical Data





Clamp special tool 31.3.121, 122 on the jaw support in the vise.

Caution!

Do not squeeze together guide bore.



Take up spring strut shock absorber in the special tool and compress the coil spring.



Unscrew nut with special tool 31.3.170, 210 (exchanging wrench socket if necessary) and take off spring strut shock absorber.

Installation instruction:

Replace self-locking nut.

Tightening torque 31.31.34.2*



Installation instruction:

Check rubber damper with protective tape and spring rings, replacing if necessary.

Note installation sequence, see arrangement

of spring strut shock absorber

Ends of springs must locate in the recesses of the plane spring.

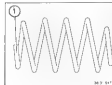
* Refer to Specifications

31 33 001 REPLACING LEFT OR RIGHT SPRING STRUT MOUNT

The procedures are identical with those for
"Replacing Spring Strut Shock Absorber"
in 31 31 031

31 33 100 REPLACING COIL SPRING FOR LEFT OR RIGHT FRONT SPRING STRUT

The procedures are identical with those for
"Replacing Spring Strut Shock Absorber"
in 31 31 031



Important!

Only install parts of springs on one axle
with the same **SAFARI** part number (1) (found
on end of the spring).

Refer to the Parts Microfiche for a survey
of springs according to vehicle types and,
if applicable, special equipment such as air
conditioner, sport suspension, etc. as well
as introduction dates.



31-33 MEASURING • CORRECTING RIDE LEVEL HEIGHT

Load down car to normal position*.

Measure actual height (A) from wheel house lower edge (1) to rim flange (2) at center of wheel height. Determine the mean value of each wheel after lifting and lowering the car body, and then the mean value of the data.

In case of deviation from the nominal value*, install new coil springs. Refer to parts catalogue for information on determining correct coil springs.

* Refer to Specifications

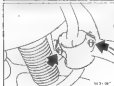


31-35-000 REMOVED AND INSTALLING FRONT STABILIZER

Loosen left and right nuts

Installation

Tightening torque*



Loosen left and right nuts
Remove the stabilizer

Installation

Tightening torque*

31 50 000 Removing and installing or replacing the front axle differential

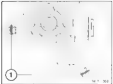
Removing input shaft from front axle differential
Ref. see 31 20 000
Removing left and right output shafts
see 31 60 000



Attach engine to special tool 00 0 200. The top ports locate against the screw connection at the side wall.



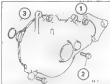
Place new (w/)
LH engine using special tool 00 0 200 and turn output (1) outwards.



Unscrew and drain off transmission oil

Installation instruction:
Replace sealing rings (1). Fill with transmission oil**
Tightening torque 31 60 6A2 - 6A2*

* Refer to Specifications
** Refer to Consumables Specifications



Unscrew nuts (1) and screws (2).

Installation instruction:
Always replace sealing ring (2)
Tightening torque 31 60 6A2*



Press front axle differential away from engine oil pump and remove by lowering downwards.

If necessary, replace sealing ring, see 31 51 005

Running-in note for exchange or repairs to the front axle differential†

The running-in rules and the oil change interval for new vehicles apply.
Up to 1000 km: max. permitted roadspeed = 3/3rd top speed.
A label or tag should be provided to remind the driver.

† Refer to Specifications

31 51 010 Replacing shaft seal for input flange on front axle differential

Removing input shaft from front axle differential see 31 51 20

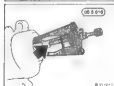


Lower out retaining plate (1). Mark the position of the nut on the shaft with punch marks.



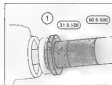
Use special tool 31 5 030 to brace the input shaft and unscrew nut. Remove input flange.

Caution*
If an input flange is badly worn, it must be replaced, see 31 51 510.



Shaft seal with special tool 31 5 010 stretches.

Caution*
Do not damage the bush in the shaft.



Dip the shaft seal (1) in oil* and drive freely home with special tool 31 5 120. 31 5 500.



Clean and fit input flange. Tighten nut until punch marks on nut and shaft are aligned with each other.

Caution*
Under no circumstances tighten the nut beyond the punch marks since it is otherwise necessary to replace the clamping sleeve, see 31 51 512 Replacing Input Flange. For this, the punch marks should be aligned before starting work.

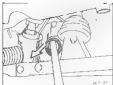
Replace retaining plate (1). Flip up oil* in front axle differential.

31 51 015 REPLACING SHAFT SEAL FOR
LEFT OUTPUT SHAFT

Remove output shaft - refer to 31 50 000

31 51 020 REPLACING SHAFT SEAL FOR
RIGHT OUTPUT SHAFT

The procedures are the same as those for
"Replacing Shaft Seal for Left Output Shaft"
in 31 51 015



Lever the shaft seal out with help of a 194
mm



Tap the shaft seal in gear tube and drive it
in as far as the stop using Special Tool
33 1 370

31 51 060 REPLACING RIGHT FRONT AUX. FINAL DRIVE O-RING

The procedures are identical with those for
"Replacing Front Axle Final Drive" in
31 50 000.

31 51 061 REPLACING RIGHT CONSOLE O-RING

Remove right output shaft - refer to
31 50 000.



Unscrew the bolts and remove the console

Installation
Remove washer (1).
Tightening torque*



Replace O-ring (1).

Installation
Dip the O-ring in gear lube



31 51 512 Replacing input flange

Front axle differential removed -

Unscrew bolts
Remove cover and shim



Lever out retaining plate (1)



Use special tool 30 2 010 or 30 2 006 to determine the friction torque of the drive pinion bearing and note down result.



Use special tool 33 0 000 to press the input flange and unlock the nut.
Remove input flange

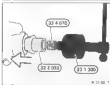


Remove shaft seal with special tool 30 5 010

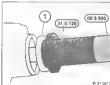
Caution!
Do not damage the teeth in the shaft.



Drive drive pinion off inner bearing race of outer bearing with plastic hammer or tip, pull off with press if necessary.
Replace clamping plate (1).



Pull drive pinion from inner bearing race with special tools 32 2 032, 33 4 070 and 33 1 300.



Tap shaft seal (1) on out* and drive flange from shaft with special tool 31 5 100 + 30 5 000.

* Refer to Consumables Specifications



Clean new nut. Range effect and tighten the new nut with special tool 23 5 070 to a tightening torque of 31 32 1 A2*



Use special tool 23 5 070 or 23 5 080 to measure the friction moment. Gradually tighten the nut until the friction moment reaches the specified value + 20 Nm for the new shaft seal.

Caution!

If the nut was tightened too far, replace the clamping sleeve. Loosening the nut to adjust the friction value is not permitted.

Replace L&B washer

Install differential housing

Clean seating face of housing and cover and

coat with sealing compound**

Secure down cover to tightening torque

21 50 5 A2*

Tap up oil** to front axle differential

* Refer to Specifications

** Refer to Consumables Specifications

*** Source of Supply: BMW Parts Service

31-53-060 REPLACING RIGHT OUTPUT SHAFT BEARING (IN CONSOLE)

Remove right output shaft - refer to 31-50-090.

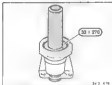
Unscrew the bolts and remove the console

Attention
Use washers (1).
Tightening torque*

Pull the bearing out together with the shaft seal using Special Tool SO 8 550

Press a new bearing in using Special Tool SO 1 290

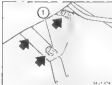
* Refer to Specifications



Dip the new shaft seal in gear tube and drive it in as far as the stop using Special Tool SO 1 270.



Dip new O-ring (1) in gear tube and push it on.



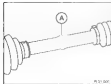
31-60-000 Removing and installing or replacing left or right output shaft

After assembly:

Check that output shafts are correctly located in front axle differential.
Check oil level.

Caution:

If an output shaft without web is replaced with an output shaft with web (A), a new detent must be installed on the engine mounts - in accordance with Parts film - on the appropriate side.



Remove cover on front wheel.
Unfasten collar nut.

Installation instruction:

Replace collar nut.

Tightening torque:

Peen (secure) the collar on the nut with a punch in both grooves of the shaft.

* Refer to Specifications



Remove front wheel, see 60-30
Unfasten cover.

Installation instruction:
Tightening torque*



Unscrew bolts (1)

Installation instruction:

Fit bolts (2)

Tightening torque*



Unscrew bolts (1).

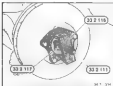
Pull control arm to one side and secure to spring strut with wire to ensure that the ball joint on the spring strut is not damaged.

Installation instruction:

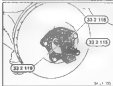
Fit washer to the front screw (2).

Tightening torque*

* Refer to Specifications



Screw on special tool 33 2 115 115 117 with 3 wheel studs.
Press output shaft out of left and right sides of driver flange.



Installation instruction:
Screw on special tool 33 2 115 115 118 with 3 wheel studs.
Pull output shaft into the driver flange.



Slide special tool 31 5 110 into the gap between housing and output shaft. Lower out left and right sides of output shaft with a jack and ramps.

Installation instruction:
The snap ring on the output shaft must suitably route in the front axle differential.

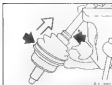


Warning:
This retaining ring on the output shaft must always be replaced.

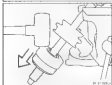
If necessary, replace shaft seal, see 31 51 015.

31 60 020 Replacing one constant velocity joint (outer) on the output shaft

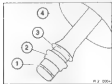
Remove output shaft 31 60 000



Clamp output shaft in vice with aluminum jaws.
Unscrew both clips and remove gaiter.



Use a plastic Hammer to drive the constant velocity joint off the spline shaft.



Remove retaining ring (1), adapter ring (2), outer spring (3) and gaiter (4).
Clean spline shaft.

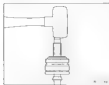


Slide on new gaiter (4).
Fit new plate spring (3) and new adapter ring (2) - new installation position.
Insert new retaining ring (1) in the groove.



Apply approx. 2-3 of volume of grease from the 1 liter tube in the new constant velocity joint.
Distribute the remaining grease in the gaiter.

Caution!
Only use grease from the blue tube



Use a plastic Hammer to drive the constant velocity joint on to the spline shaft until the retaining ring engages in its functional position.



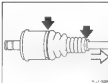
Fit gaiter to constant velocity joint and move spline shaft in its installation position.
Insert screwdriver between gaiter and spline shaft and turn constant velocity joint.
Secure gaiter with new clips.

31 60 030 Replacing one garter on the output shaft (outer)

Work is identical to 31 60 020 - Replacing Constant Velocity Joint (outer).

Caution!

Clean the constant velocity joint thoroughly.



31 60 035 Replacing both garters on the output shaft

Remove constant velocity joint (outer), 31 60 020.

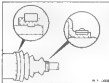
Unfasten both clips on inner joint and remove garter.

Do not dismantle the joint!

Clean the joint thoroughly.
Insert approx. 2/3 of the volume of grease in the two white tubes into the joint.
Distribute the remaining grease in the new garter.

Caution!

Only use grease from the white tubes.



Move garter on joint and on spline shaft into installation position.
Insert screwdriver between garter and spline shaft and turn point.
Secure garter with new clips.

TROUBLESHOOTING FRONT AXLE

Condition	Causes	Correction
Grinding noise (louder in curves)	a) Wheel bearings faulty	a) Replace wheel bearings
Vibration	a) Imbalance of wheels b) Rim lateral and radial runout c) Tire radial runout d) Output shaft faulty	a) Balance wheels b) Replace rims if necessary c) Replace output shaft d) Replace output shaft
Steering wheel shake	a) Imbalance of wheels b) Rim lateral and radial runout c) Shock absorber effect insufficient d) Control arm mounts faulty e) Wrong control arm mounts installed f) Excessive steering gear play g) Output shaft faulty	a) Balance wheels b) Replace rims if necessary c) Replace shock absorbers d) Replace control arm mounts e) Exchange control arm mounts f) Adjust pressure point g) Replace output shaft
Rattling noise	a) Control arm ball joint worn b) Stabilizer rubber mounts worn c) Thrust strut ball joints worn d) Front axle carrier mounted loose at body	a) Replace control arm b) Replace rubber mounts c) Replace thrust strut d) Tighten (check threads)
Load change knock	a) Excessive backlash b) Output shaft faulty	a) Adjust backlash b) Replace output shaft
Acceleration or overrun noise	a) Backlash excessive or insufficient	a) Adjust backlash
Oil leak	a) Radial oil seal leaks b) Vents plugged c) Wrong oil grade	a) Replace radial oil seal b) Clean vent c) Replace front axle final drive oil*

* Refer to Operating Fluids

TROUBLESHOOTING FRONT AXLE

Symptom	Cause	Correction
Body leveling long time after driving car over rough road		
Body dip when driving car over successive rough road surfaces		
Body rise while accelerating	Weak shock absorbers. refer to troubleshooting shock absorbers on page 31-90/3	Replace shock absorbers.
Wheel jump even on normal road surfaces		
Car breaking out while braking		
Braking out (skidding) in curves due to poor track holding		

The condition of shock absorbers can be checked with a shock absorber tester or in a shock absorber testing machine.

TROUBLESHOOTING SHOCK ABSORBERS

Condition	Causes	Correction
Shock absorbers knocking (rattling)	a) Rubber dampers faulty b) Weak shock absorbers	a) Check or replace rubber dampers b) Replace shock absorbers
Shock absorber noise	a) Newly installed shock absorbers had been stored lying down with piston rod run in b) Shock absorbers faulty	a) Store shock absorbers standing upright with piston rod run out and at room temperature for 24 hours b) Replace shock absorbers
Poor handling properties	Shock absorbers faulty	Replace shock absorbers
Flat spots on tire treads	Shock absorbers faulty	Replace shock absorbers

32 Steering and wheel alignment

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GENERAL INFORMATION**Steering Gear**

The steering gear could be damaged from impact forces if a car is involved in an accident or operated under conditions similar to an accident. There must always be conformance with factory specifications in the interest of safety - refer to Service Information 32-01-88 (828).

Tie Rod Joint

Refer to Service Information 32-00-87 (728) for an evaluation of wear on ball joints.

Suspension

Troubleshoot with BMW DIAGNOSING SYSTEM - refer to Car Electric/Electronic Test Plan.

Airbag

Troubleshoot with BMW DIAGNOSING SYSTEM - refer to Car Electric/Electronic Test Plan.

MS

The rear wheel toe can be adjusted.

Electric Steering Wheel Adjustment

Troubleshoot with BMW DIAGNOSING SYSTEM - refer to Car Electric/Electronic Test Plan.

Car with Interlock System

The function must be checked if a component of the interlock system had been removed and installed or the installed position of the interlock cable was changed - refer to 32-32-70.



GENERAL INFORMATION AND DEFINITIONS

Toe

is the reduction in distance of front or front wheels to rear or front whips. Toe prevents the wheels from running apart while driving and consequently wheel steering and grinding, excessive tire wear, excessive loads on steering linkage and joints as well as hard steering of car. Toe is measured in "straight ahead position".



Camber

is the inclination of the wheel from the perpendicular



King pin inclination

is the angle, by which the "king pin" is inclined inward from a perpendicular line to the lateral axis of the car. The king pin inclination produces returning forces, which return the road wheels and steering wheel to straight ahead after driving through a curve or around a corner.

Camber and king pin inclination determine the location of the wheel contact point with the road surface.

King pin inclination reduces the leverage on which lateral forces are engaged, which makes it easier to turn the wheels to left or right lock. In addition, the jolts from rough road surfaces do not have so strong influence on the steering.

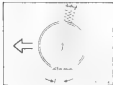
Toe difference angle

is the angular position of the wheel on the inside of a curve to the wheel on the outside of a curve when driving in a curve. The steering is designed so the angular position of the wheels changes as steering lock progresses. The toe difference angle provides information on the pertinent operation of the steering components for left or right steering lock from the center position. A correctly adjusted toe difference angle produces equal values for left and right lock in our consideration for factory tolerances.

- = toe difference angle
- = turning circle center point



* The "king pin" is equal to a line through the center point of the spring strut mount and control arm ball joint.



Camber

is the inclination of the king pin's forward direction as seen from the side.

The wheels are pulled and not pushed because of caster in a similar manner to king pin inclination, when driving in curves or around corners, returning forces are produced to help return the wheels to straight ahead position.



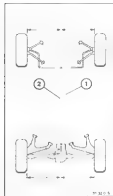
King pin angle

is the angle, by which one front wheel is disposed more toward front or rear than the other front wheel.



King pin angle scrub radius.

is the distance from the center of the point of contact between the wheel and road to the point of intersection of an extended king pin's axis.
Scrub radius is influenced by camber, king pin inclination and rim offset.



Geometrical axis 1

is the bisecting line of an angle from the solid rear wheel too.
Front wheel measurements are taken in reference to this axis.

Symmetrical axis 2

is a center line running through the front and rear axles.

The "king pin" is equal to a line through the center point of the spring strut mount and control arm ball joint.

The "king pin" is equal to a line through the center point of the spring strut mount and control arm ball joint.

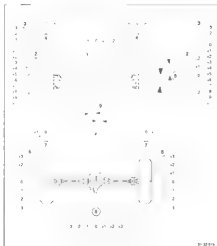
32 08 180 CHECKING WHEEL ALIGNMENT WITH ELECTRONIC TESTER (OWN KODU)

Requirements to be fulfilled prior to checking wheel alignment:

1. Good, uniform tire treads
2. Specified tire pressure*
3. Wheel rims in perfect condition†
4. Specified wheel loading (axle)
5. Car loaded down to normal position‡
6. Specified ride spring height

Always check wheel alignment only with a recommended electronic tester (see Work Shop Equipment) and also use turntable on the rear wheels.

- 1 = Toe
- 2 = Camber
- 3 = Caster (with 10° or 20° wheel lock)
- 4 = Toe difference angle (with 20° wheel lock)
- 5 = Wheel offset
- 6 = Camber
- 7 = Rear wheel position
- 8 = Toe
- 9 = Geometrical axis



* Refer to Specifications of Car 32 00 00 00

† Refer to Service Information of Car 32



32 00 010 Adjusting front axle (with KDS)

Adjust toe-in and toe-out angles.
Set steering gear in straight ahead position (steers on rising and steering shaft must agree).



Loosen both clamping screws of tie rod.
Adjust toe-in of left and right wheel by turning the threaded stems to the specified setpoint*

Installation note
Make sure the ball joint is not twisted.
For tightening torque*



Four-wheel drive:
Loosen nut.
Adjust toe-in of left and right wheel by turning the tie rod to the specified setpoint*

Installation note
Make sure the ball joint is not twisted.
For tightening torque*



32 00 020 Adjusting rear axle (with KDS)

Loosen nut.
Adjust toe-in on left and right wheel by turning the eccentric screw to the specified setpoint*

Installation note
Firmly tighten screw on right-hand semi-trailing arm with special tool 32 1 080 to tightening torque*

32 30 CORRECTING CAMBER

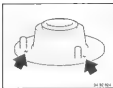
Eccentric mounts can be installed to correct the front axle camber by an 30°, when deviation is caused by the summing of tolerable tolerances.

Important!

This measure must never be applied to eliminate changes in the axle geometry caused in an accident.

Example

Nominal camber value	+ 7° - + 43
Actual camber value	- 60°
Correction added	+ 30°
New actual value	- 30°



Correction mounts are marked with "+" or "-" next to the stud.
Replace spring strut mounts - refer to 32 32 left.

TROUBLESHOOTING FRONT WHEEL ALIGNMENT

Condition	Causes	Correction
1. Toe deviation	<ul style="list-style-type: none"> a) Car not in normal position b) Tie rod(s) bent c) Track arm on spring strut bent d) Tie rod ball joints worn e) Rubber mount in control arm faulty 	<ul style="list-style-type: none"> a) Ride level height, see Specifications of Group 3n b) Replace tie rod(s) c) Replace track arm d) Replace tie rod(s) or ball joints e) Replace rubber mount
2. Camber deviation Camber is given by design and cannot be adjusted.	<ul style="list-style-type: none"> a) Rubber mount in control arm faulty b) Control arm deformed c) Spring strut deformed d) Guide joint worn e) Spring force insufficient f) Front axle carrier deformed g) Spring strut mount holder deformed h) Distortion in floor assembly (engine carrier) i) Unfavorable summary of tolerances 	<ul style="list-style-type: none"> a) Replace rubber mount b) Replace control arm c) Replace spring strut d) Replace control arm e) Replace coil springs f) Ride level height, see Specifications of Group 3i f) Replace front axle carrier g) Repair front end h) Repair body i) Install eccentric mounts
3. Caster deviation Caster is given by design and cannot be adjusted.	<ul style="list-style-type: none"> a) Rubber mount for thrust strut faulty b) Thrust strut deformed c) Control arm deformed d) Spring strut deformed e) Wheel house deformed (spring strut mount) f) Distortion in floor assembly (engine carrier) 	<ul style="list-style-type: none"> a) Replace rubber mount b) Replace thrust strut c) Replace control arm d) Replace spring strut e) Repair front end f) Repair body
4. Toe difference angle deviation	<p>Assuming camber and caster are correct:</p> <ul style="list-style-type: none"> a) Tie rods not adjusted uniformly b) Track arm on spring strut bent 	<ul style="list-style-type: none"> a) Adjust toe on left and right sides to same value b) Replace track arm
5. Wheel offset deviation	<p>Assuming front wheels have equal angle toe to geometrical axis:</p> <ul style="list-style-type: none"> a) Front axle carrier deformed b) Engine carrier deformed c) Control arm deformed d) Thrust strut deformed 	<ul style="list-style-type: none"> a) Replace front axle carrier b) Repair body c) Replace control arm d) Replace thrust strut

TROUBLESHOOTING REAR WHEEL ALIGNMENT

Condition	Cause	Correction
6. Camber deviation	<ul style="list-style-type: none"> a) Car not in normal position b) Spring force insufficient c) Rubber mounts on rear axle carrier faulty d) Rubber mounts on final drive faulty e) Silent blocks in trailing arm faulty f) Rear axle carrier deformed g) Trailing arm deformed h) Distortion in floor assembly 	<ul style="list-style-type: none"> a) Ride level height, see Specifications of Group 33 b) Replace rubber mounts c) Replace rubber mounts d) Replace silent blocks e) Check or replace rear axle carrier f) Check or replace trailing arm g) Repair body
7. Rear wheel position deviation	<ul style="list-style-type: none"> a) Rear axle carrier displaced laterally b) Distortion in floor assembly 	<ul style="list-style-type: none"> a) Check / replace rubber mounts on rear axle carrier b) Repair body
8. Toe deviation	<ul style="list-style-type: none"> a) Car not in normal position or spring force insufficient b) Rubber mounts in rear axle carrier faulty c) Rubber mounts on final drive faulty d) Silent blocks in trailing arm faulty e) Rear axle carrier deformed f) Trailing arm deformed g) Unfavorable sumitivity of tolerances 	<ul style="list-style-type: none"> a) Ride level height, see Specifications of Group 33 b) Replace rubber mounts c) Replace rubber mounts d) Replace silent blocks e) Check or replace rear axle carrier f) Check or replace trailing arm g) Install eccentric silent blocks see 32 32 541
9. Deviation of geometrical axis from symmetrical axis	<p>Assuming single wheel toe cannot be adjusted</p> <ul style="list-style-type: none"> a) Distortion in floor assembly 	<ul style="list-style-type: none"> a) Repair body



32 13 006 Filling and bleeding power steering

1 Fill with engine stationary

Fill oil container to display mark "MAX" or to A - approx. 25 mm below the edge with hydraulic fluid^{*}

2 Bleeding

Start engine

Turn steering wheel to left and right locks twice each way

3 Oil level check with engine stationary

a) Without level regulation

Fill up to "MAX" mark.

b) With level regulation:

Lift rear axle until wheels are suspended.
After 2 minutes, the oil level should be max. 5 mm over the base of the screen.

Correct oil level as required with engine stationary

On ASC + T vehicles, see 34 90 040

32-13/2



32 12 018 ADJUSTING PRESSURE POINT IN POWER STEERING GEAR

Requirements
Steering gear and mounting points of steering column in perfect condition

Unassemble the nut
Press the tie-rod off of the steering drop arm using Special Tool 32 2 040

Installation
Replace the self locking nut / tightening torque*



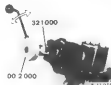
Adjusting

Turn the steering wheel counterclockwise about 1 turn from straight ahead position. Loosen nut (1) on the steering gear and turn adjusting screw (2) until the specified friction torque* is reached while passing the pressure point

Installation
Tightening torque* for nut
Recheck the pressure point



Set the steering gear in straight ahead position (marks on spindle and case)



Steering Gear Removed
Mount Special Tool 32 1 000 on the spindle and apply Special Tool 32 2 000.
Adjust as described above.



Lift the BMW emblem out or remove the airbag unit - refer to 32 34 020.
Turn the steering wheel counterclockwise about one turn.
Mount Special Tool 32 2 000, turn the steering wheel clockwise past the pressure point and read the friction torque*

* Refer to Specifications

* Refer to Specifications

32 13 000 REMOVING AND INSTALLING POWER STEERING GEAR

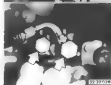
Push the hydraulic fluid out of the tank don't reuse it

Preparation

Fill and bleed the hydraulic system - refer to 32 18 000

Car's with Airbag

Remove the steering wheel - refer to 32 13 000



Installation

Check the straight ahead position of the steering wheel and steering gear
Turn the steering wheel counterclockwise or clockwise as far as lock and then back about 1.7 turns until the marks are aligned

Unscrew the hydraulic pipes

Plug the lines with dust caps

If applicable, put the plug off of the connector for Servotronic

Refer to

Refer to

Tightening torque*

Ball-and-nut Power Steering

Unthread nut

Press the tie rod off of the steering drop arm using Special Tool 32 3 040

Installation

Replace the anti-locking nut
Tightening torque*

Unscrew bolt

Push the universal joint off of the steering shaft

Installation

The bolt must be in the locking groove of the steering shaft
Tightening torque*



Unscrew bolts (1 and 2)

Remove the steering gear

Installation

Tightening torque*,

- 1 Bolt (only use grade 12.9)
- 2 Bolt
- 3 Bushing
- 4 Nut
- 5 Nut (replace)

* Refer to Specifications

* Refer to Specifications





Back-end-plate Power Steering
Remove the front wheels - refer to Qr 30.
Unscrew left and right nuts (1).

Installation
Replace the self-locking nuts,
install washers (2).
Tightening torque*

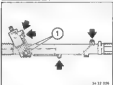


Press the left and right track rods off using
Special Tool 32 1 090



Unscrew steering gear bolts (1).

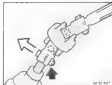
Installation
Replace seals (2).
Tightening torque*



Unscrew return pipes (1) from the steering
gear

Installation
Replace the seals.
Tightening torque*

* Refer to Specifications



Remove the bolt and disconnect the joint
from the steering gear

Installation
The bolt must be located in the groove of
the steering gear spindle.
Replace the nut.
Tightening torque*



Unscrew left and right nuts.
Remove the steering gear from the axle

Installation
Tightening torque*

* Refer to Specifications

DESIGN AND DESCRIPTION OF BALL AND ROLL POWER STEERING

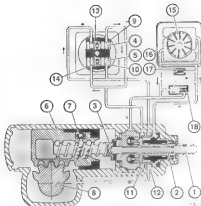
The housing contains a complete mechanical steering gear. The control valve and operating cylinder. Steering spindle (1) is connected elastically with worm (2) via tension bar (3) and with valve pistons (4 and 5) without play. The valve pistons are installed transversely in the worm head. The connection between piston (6) and worm (2) is accomplished with an infinite line of balls. When turning the worm (the balls are taken up in one end by circulating tube (7) and put out again at the other end of the balls. Piston (8) and sector shaft (9) are meshed. The special shape of teeth on the sector shaft permits zero-play adjustment with an adjusting screw.

In neutral position of valves (4 and 5) the oil flow delivered by the pump passes through the steering gear and can flow through the opened feed and return control edges to the cylinder chamber and return flow. Hydraulic support oils in which force is transmitted from the steering wheel or from the steering drop arm via the sector shaft and pistons to the worm. Tension bar (3) when turned as a lever, it deforms itself in the elastic range and returns the valve pistons to neutral position after releasing the steering wheel (steering wheel of ball 7), will let the oil flow into only one of the operating cylinder chambers and in this manner support the rotating motion of the steering spindle and/or counteract the pull from rough roads.

Steering Wheel in Neutral Position

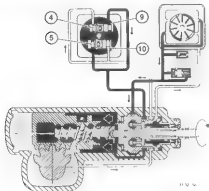
Oil flows from the impeller pump into the worm head, through feed grooves (8 and 10) to roller grooves (11 and 12). From here via connecting tubes to the right and left cylinder chambers and via opened return flow grooves (13 and 14) back to the oil tank. The valve is also illustrated in cross section.

- 15 = Pump
- 16 = Oil tank
- 17 = Pressure relief valve
- 18 = Control valve



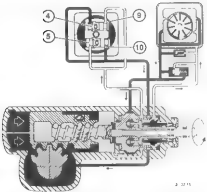
Steering Wheel Turned Clockwise

Valve piston (4) is displaced to the right and feed groove (3) opened. Valve piston (5) is displaced to the left and feed groove (10) closed—This lets the oil flow into the right cylinder chamber. Oil in the left cylinder chamber is forced out and flows back into the oil tank.



Swearing Wheel Turned Counterclockwise

Valve piston (5) is displaced to the right and feed groove (9) opened. Valve piston (4) is displaced to the left and feed groove (8) closed. This lets the oil flow into the left cylinder chamber. Oil in the right cylinder chamber is forced out and flows back into the oil tank.



ELECTROHYDRAULIC

Components

Electronic speedometer

Control unit (installed in A pillar)

Electro/hydraulic converter (bolted on steering gear)

Design

The speed signal from the speedometer is inducted in the control unit and put out to the converter in form of electric pulses. The converter regulates the flow of oil out of the reaction chambers into return flow.

Description

Turning the steering wheel clockwise causes the right valve piston (6) to move. This lets the oil flow into the right cylinder chamber (12) as well as via the right check valve (8) into the right reaction chamber (4).

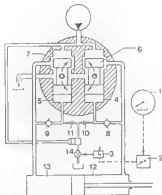
When the car is in "parking" state (there are no speed signals from the speedometer), converter valve (3) remains closed and the oil continues to flow via both valves (10 and 11) to the left reaction chamber (5). The closed left check valve (9) prevents the oil from flowing into the pressurised left cylinder chamber (13) which is connected with return flow. Since there is equal pressure in both reaction chambers (4 and 5), there is no counterforce (no resistance) on the steering wheel. The steering wheel is easy to turn.

When driving fast on "highways", the converter valve is wide open and the oil flows from the pressurised right cylinder chamber (12) via the right check valve (8) right piston (10) and converter (3) to return flow. The right reaction chamber (4) then has full pressure while the left reaction chamber (5) is without pressure. This produces a left turning torque, which tries to force the valve piston back into neutral position (maximum reaction). The steering wheel is hard to turn.

When driving at medium speed, converter valve (3) is opened only partially. The reduced counterpressure is transmitted to the left reaction chamber (5) via the right reaction chamber (4) at maximum pressure. The counterforce acting on valve pistons (6 and 7) is lower accordingly.

Cross Section Drawing of Valve in Warm Heat (also refer to page 32 13/8)

- | | |
|-------------------------------|---------------------------|
| 1 Speedometer | 8 Check valve right |
| 2 Control unit | 9 Check valve left |
| 3 Electro/hydraulic converter | 10 Orifice right |
| 4 Reaction chamber, right | 11 Orifice left |
| 5 Reaction chamber left | 12 Cylinder chamber right |
| 6 Valve piston, right | 13 Cylinder chamber, left |
| 7 Valve piston, left | 14 Reaction limit valve |



32 13 583 Disassembling and assembling power steering gear

- Power steering gear removed

Remove tie rods, refer to 32 21 234

Caution!

Take the utmost care and ensure absolute cleanliness when working on the steering gear. Do not use any force whatsoever during disassembly and assembly work. The use of force can cause damage which can lead to failure of the steering system.

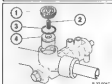
Prevent leakage and

Detach delivery lines and remove O-rings.

- 1 Mark position of adjusting screw (1) with respect to housing with center punch (484).
- 2 Determine installation depth of adjusting screw (1) by tapping with a depth gage and note down.
- 3 Release adjusting screw (1).
- 4 Remove spring (2), O-ring (3) and spacer (4).



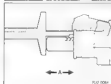
32 13 583



32 13 583



32 13 583



32 13 583



32 13 583



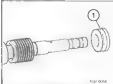
32 13 583

Remove seal cap

Set steering gear in null-position (by turning total number of turns). In this position, the marks on the steering spindle, cap and housing agree. Make marks if necessary. Determine dimension (A) with a depth gage and note down. This dimension is required as a check during assembly.

Remove protective cap (1) from steering shaft. Release nut - hold on rim of steering shaft -

Lever out snap-ring. Pull steering shaft out of housing.



Remove bearing bush (1).



Using special tool 32 1 140/294, remove radial oil seal (2) together with bearing (3) out of bearing bush (1).



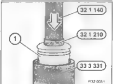
Disconnect connection for leakage of oil.



Remove snapping through hole for leakage of oil and pull out of housing.



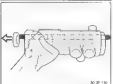
Pull gear rock with bearing bush (1) out of housing.



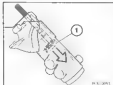
Remove radial oil seal from bearing bush (1) with special tool 32 1 140/210 and 33 3 331.



Remove radial oil seal out of tube with special tool 32 1 140/210.



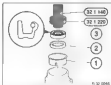
Remove bearing out of starting shaft housing. This improves access to the radial oil seal.

**Caution!**

Do not damage polished cylinder bore.
With the aid of a drift punch, carefully drive radial oil seal (1) out of steering shaft housing.

Thoroughly clean all parts.

Coat new sealing rings with hydraulic fluid and pack, rather use fit seal between dust cap and sealing lip with grease, refer to SAE Fluids and Lubricants Specifications.



Fit plastic bush (1) and support ring (2) in the bore.

Fit new radial oil seal (3) - open side facing towards special tool (32 1 140/230) - as far as it will go in the tube.

**Grease bearing.**

refer to SAE Fluids and Lubricants Specifications and, using special tool 32 1 140/130 fit in steering shaft housing as far as it will go.

**Replace O-ring (1).**

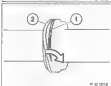
Fit new plastic bush (2) and support ring (3) in bearing bush.
Radial oil seal (3)



Fit new radial oil seal (3) - open side facing towards special tool 32 1 140/230 - as far as it will go in the steering shaft housing.



Fit new radial oil seal (3) - with open side facing towards special tool 32 1 140/230 - as far as it will go in the bearing bush.



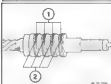
Replace O-ring (1) and piston ring (2).



Carefully insert gear rack in the tube, making sure:
1. The inner radial oil seal is not damaged by the gear teeth and
2. the piston ring (2) is not damaged.
Fit bearing bush on gear rack, and fit in tube.



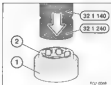
Fit new snap-ring with the open side located opposite the leakage oil hole.



Replace piston rings (1) and O-rings (2) below them.



Fit new radial oil seal (3) - open side facing upwards - as far as it will go in bearing bush (1) with special tool 32 1 140/240/250.
Replace O-ring (2).



Fit bearing bush (2) - labelling facing upwards - as far as it will go in bearing bush (1) with special tool 32 1 140/240/250.



Fit bearing bush (2) - radial oil seal facing upwards - on steering shaft.



Grease rack and pinion, refer to BMW Fluids and Lubricants Specifications.
Pull out rack by dimension (A) noted above.
Carefully insert steering shaft in housing and fit snap-ring.
Check marks.



Fit new protective cap in this position where marks on housing, steering shaft and protective cap must agree.



Replace anti-locking nut and tighten to tightening torque ± 17 Nm.



Tighten and gap to tightening torque ± 32 Nm and fix in position by caulking.

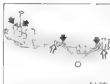


Replace Shim (1) and O-ring (2).



Grease thrust plate (4), spring (2) and O-ring (3) and fix in position.
Screw in adjusting screw (1) to the determined installation depth and edge marks.
Secure adjusting screw in position by caulking.
Caution!

It must be possible to move the rack smoothly over its entire range.



Fit leakage oil line connections.
Connect leakage oil line and install delivery lines with new O-rings.
Tightening torque ± 20 Nm.

TROUBLESHOOTING BALL AND NUT POWER STEERING

Condition	Cause	Correction
Steering hard to turn left or right from center	Pressure point adjusted too tight	Adjust pressure point
Steering runs automatically to final position one-sidedly	Valve getting for hydraulic center incorrect	Replace steering gear (adjusting only possible in the factory)
Steering wheel has excessive play	a) Steering gear loose on front axle carrier b) Universal joints have excessive play c) Joint disk loose d) Tie rod ends worn e) Play between worm and piston f) Worm has axial play g) Insufficient oil in system	a) Tighten steering gear b) Replace universal joints c) Tighten joint disk d) Replace tie rod ends e) Replace steering gear f) Replace steering gear g) Add oil* and bleed power steering - see 32 13 006
Steering wheel shakes	a) Wheels have imbalance or radial runout b) Toe, camber, caster or king pin inclination incorrect c) Thrust strut bent d) Rubber mount for thrust strut defective e) Control arm bent f) Wheel shock absorbers g) Bearing sleeve in steering guide arm defective	a) Balance wheels, replace rim or tire in case of radial runout b) Check/adjust front wheel alignment with optical laser c) Replace thrust strut d) Replace rubber mount e) Replace control arm f) Replace shock absorbers g) Replace bearing sleeve
Steering is hard to turn against left or right lock	a) No pressure built up in lower pressure chamber b) No pressure built up in upper pressure chamber c) Insufficient oil in system d) Control valve in power pump seized e) Filter clogged f) Valve piston seized or leaks g) Piston seal damaged h) Teflon rings in worm head leak i) Teflon ring in intermediate cover leaks k) System filled with wrong bearing, unsuitable oil	a) Replace steering gear b) Replace steering gear c) Add oil* and bleed power steering - see 32 13 006 d) Replace power pump e) Replace filter, clean lines f) Replace steering gear g) Replace steering gear h) Replace steering gear i) Replace steering gear k) Fill system with specified oil*

* Refer to Specifications

TROUBLESHOOTING BALL AND NUT POWER STEERING

Condition	Cause	Correction
Loss of hydraulic fluid	<ul style="list-style-type: none"> a) Hose connections leak b) Oil tank seal leaks c) Radial oil seal for sector shaft defective d) Radial oil seal for steering spindle defective e) O-ring in cover leaks f) O-rings in intermediate cover leak 	<ul style="list-style-type: none"> a) Tighten hose connections or replace hoses b) Replace seal c) Seal steering gear d) Seal steering gear e) Seal steering gear f) Seal steering gear
No straight ahead	Height of steering drop arm not correct	Adjust steering drop arm - see 32.21.320

TROUBLESHOOTING RACK AND PINION POWER STEERING

Problem	Cause	Correction
Steering hard to turn left or right from center	Pressure point not adjusted correctly	Replace steering gear
Steering runs automatically to limit position consistently	Valve setting for hydraulic center incorrect	Replace steering gear (adjusting only possible in the factory)
Steering wheel has excess tie play	<ul style="list-style-type: none"> a) Steering gear loose on front axle carrier b) Universal joints have excessive play c) Joint disk loose d) Tie rods worn e) Worm has axial play f) Insufficient oil in system 	<ul style="list-style-type: none"> a) Tighten steering gear b) Replace universal joints c) Tighten joint disk d) Replace tie rods e) Replace steering gear f) Add oil* and bleed power steering - see 32-13-006
Steering wheel shakes	<ul style="list-style-type: none"> a) Wheels have imbalance or radial runout b) Tie, control, steering or king pin adjustment incorrect c) Control arm bent d) Weak shock absorbers 	<ul style="list-style-type: none"> a) Balance wheels, replace rim or tire in case of radial runout b) Check/adjust front wheel alignment with optical <u> </u> c) Replace control arm d) Replace shock absorbers
Steering hard to turn against left or right lock	<ul style="list-style-type: none"> a) Insufficient oil in system b) Drive belt too loose c) Filter clogged d) Control valve in jump position e) Valve pinion stuck or seized f) System filled with strong foaming unsuitable oil 	<ul style="list-style-type: none"> a) Add oil* and bleed power steering - see 32-13-006 b) Tighten or replace drive belt c) Clean filter d) Replace pump e) Replace steering gear f) Fill system with specified oil
Steering runs only difficultly to left or right lock	No pressure built up in left or right cylinder <u> </u>	Replace steering gear

* Refer to Specifications

TROUBLESHOOTING RACK AND PINION POWER STEERING

Condition	Cause	Correction
Loss of hydraulic fluid	a) Hose connections leak b) Oil tank seal leaks c) Radial oil seal for steering spindle defective d) O-ring in control valve	a) Tighten hose connections or replace hoses b) Replace seal c) Seal steering gear d) Seal steering gear
No straight ahead	a) Insufficient oil in system b) Tie rods worn	a) Add oil and bleed power steering - see 32-13 006 b) Replace tie rods
Steering runs difficult when turn to left quickly	a) Drive belt loose b) Pump delivery rate insufficient	a) Tighten or replace drive belt b) Check or replace pump
Strong knocks felt on steering wheel while steering	a) Insufficient oil in system b) Air in system in spite of sufficient oil c) Excessive play between rack and piston d) Valve body has excessive play	a) Add oil and bleed power steering - see 32-13 006 b) Check where air is being sucked in on intake side c) Replace steering gear d) Replace steering gear
Hesitant return of steering wheel	Mount, ball joint, tie rod joints or hard moving steering spindle in steering column	Check/repair or replace mount, ball joint, tie rod joints and steering spindle in steering column
Refer to Specifications		

32-21/1



32 2 040



32 20 011



Important!
Replace self locking nut
tightening torque*

- 1 Bolt
- 2 Steering guide arm
- 3 Washer
- 4 Self locking nut
- 5 From axle driver

Important!

If the steering guide arm is replaced, adjust
the steering drop arm - see 32 21 850

32 21

32 21 850 REMOVING AND INSTALLING STEERING GUIDE ARM

Unscrew nut
Press off ball joint with Special Tool
32 2 040
Installation
Replace self locking nut
Tightening torque*

Unscrew steering guide arm

* See Specifications

32-21/2



32 21 061 REPLACING DAMPER FOR STEERING GUIDE ARM

Remove steering guide arm - see 32 21 060

Press out damper with Special Tools

32 1 060 and 32 2 032

Note pressing in direction:

1 - Damper

2 - Steering guide arm



32 32 048



Press in new damper against the stop with

Special Tools 32 1 305 and 32 2 032

Important!

Adjust steering drop arm after installation - see 32 21 610

32-21/3



32 21 101 - REPLACING LEFT OR RIGHT T.E. ROD ARM

Remove front wheel - refer to Group 38
 Unscrew nut
 Press ball joint off of the rod arm using
 Special Tool 32 1 040

Installation
 Replace self locking nut
 Tightening torque*
 Check front wheel alignment - refer to
 32 00

Unscrew bolts

Installation
 Clean threads of tapered cones and bolts
 Install bolts with both cones**
 Tightening torque*



Check for correct installed position.



Unscrew nut on external cone and thrust
 cone
 Press off ball joint using Special Tool
 32 1 110

Installation
 Replace self locking nut
 Tightening torque*



* Refer to Specifications
 ** Source of Supply: Same Parts

32 21 150 REPLACING LEFT OR RIGHT

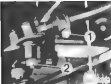
Remove the front wheel - refer to Cr. 26.

Check wheel alignment after installation.

Four Wheel Drive

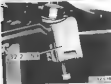
Remove the front wheel - refer to Cr. 26.

Check wheel alignment after installation.



Loosen ball (1).
Unscrew nut (2).

Installation
Replace self-locking nut (2).
Tightening torque*



Press the tie rod off using Special Tool
32 2 090.



Unscrew the tie rod end.

* Refer to Specifications.



Loosen nut (1).

Installation
Replace self-locking nut (1).
Use washer (2).
Tightening torque*



Press the tie rod off using Special Tool
32 2 090.



Measure distance (A) before unscrewing
the tie rods - measure wheel alignment
easier.
Unscrew nut.
Unscrew tie rod end.

Installation
Install clamping ring (1).
Screw tie rod end in up to distance (A).
Tightening torque*

* Refer to Specifications.

32 21 231 REPLACING LEFT OR RIGHT TIRE ROD

Important!

Adjust front wheel alignment after installation - refer to 32 09 650.

Remove the front wheel - refer to Gr. 36.

Inspection (1)

Installation

Replace self-locking nut (1).
Jolt washer (2).
Tightening torque*

Press the tie rod off using Special Tool 32 3 990.

Loosen the clamp and push the boot back.

Installation

Check - replace the boot.

* Refer to Specifications.



Understand the lockplate.

Remove the tie rod using Special Tool 32 3 990.

Important!

Understand the lockplate with a suitable plate (refer with a hammer) to avoid damaging the rack and suspension.

ing location

Replace the lockplate.

Turning lock (1) must be positioned in groove (2) of the rack.
Tightening torque*

Band the lockplate with a plate.

* Refer to Specifications.





32 21 201 REPLACING CENTER TIE ROD

Unthread nuts on left and right sides.

Inspection

Replace self-locking nuts.

Tightening torque*

Adjust steering drag arm - refer to

32 21 800

Check front wheel alignment - refer to

32 00



Free all side tie rods using Special Tool

32 3 000 and center tie rod using Special

Tool 32 3 048

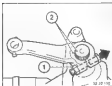
Control distance A $\pm 0.24 \pm 1$ mm



32 10 000

32 21 505 REMOVING AND INSTALLING STEERING DROP ARM - Steering Gear Removed -

Mark position of sliding steering drop arm on
the sector shaft prior to unscrewing bolt (1).
If necessary, adjust steering drop arm - see
32 21 510



Installation

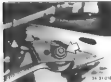
Slide on steering drop arm up to the mark,
whereby mark (2) must also be aligned.
Replace self-locking nut
"tightening torque"

32 21 8/0 ADJUSTING STEERING DROP

Adjusting the steering drop arm moves the left and right tie rods to the same height. This guarantees the same amount of toe on left and right wheels when the car's suspension is set/zeroed. It also contributes directional stability on rough road surfaces.



Set steering gear to straight ahead position (marks on spindle and case aligned).



Unsnap left and right control arms on front axle carrier.

Installation:
Replace self-locking nuts.
Tightening torque*



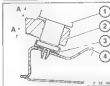
Mount Special Tool 32 2 138 on control arm (mount at the steering guide arm side). Align the master mandrel with the centering bore in the pivot pin and clamp.



Mount the special tool on the other side — without changing the master mandrel.



Loosen bolt.
Move steering drop arm until centering bore is aligned with master mandrel as precisely as possible.
Allow permissible deviation ± 1.0 mm.
Tighten nut.
Tightening torque*
Recheck adjustment if necessary.



Important!
Turn steering gear from stop to stop.
steering drop arm must move easily.

Distance A = 0.5 mm.

- 1 Steering gear
- 2 Steering drop arm
- 3 Spacer
- 4 Front axle carrier

* Refer to Specifications

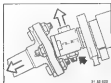
* Refer to Specifications

32-31 000 REMOVING AND INSTALLING OR REPLACING STEERING

Disconnect battery - refer to Group 88
 Remove dashboard trim panel in bottom -
 refer to Group 38
 Models with Airbag
 Remove steering wheel - refer to 32-32 000

Important*

After installation, a float steering angle for
 electronic shock absorber control - refer to
 Car Electric/Electronic Test Plan in Gr 32



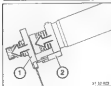
32-32 000

Remove bolt.

Press down on steering spindle.

Installation

Bolt must be located in locking groove of
 the steering spindle.
 Replace self-locking nut.
 Tightening torque*



32-32 000

Pull steering angle sensor (1) off of steering
 spindle.

Installation

Pin of steering angle sensor (1) must seat
 in turning tool (2).

* Refer to Specifications



32 31 000 REMOVING AND INSTALLING STEERING COLUMN ASST

Disconnect battery ground lead.
Remove steering wheel - refer to 32 32 000.
Remove dashboard trim panel at bottom refer to Group 51.
Check position of collar ring (1), to snap ring (2).

Unscrew steering column casing

If applicable, unscrew interface cable at steering lock



Remove bolt

Press down on steering spindle

Installation
Bolt must be located in locking groove of the steering spindle.
Replace self locking nut
Tightening torque*

Note
Mark meeting point of spindles with a dot of paint.
Screw on adjusting nut far enough that the sliding force is 40 - 25 N.



32 32 002

* Refer to Specifications



Unscrew bolts

Insert on shear-off screw

Installation

Replace self-locking nuts.
Tightening torque*
Tighten new shear-off screw until it shears off.



Installation

Insert spacer



Unscrew bolts

Loosen both mounting nuts on bracket.
Press down and remove steering column.



Installation

Insert spacer
Tightening torque*

32 32 006

* Refer to Specifications

32 32 000 REMOVING AND INSTALLING STEERING COLUMN ASSY (continued)

Caution!

Comply with safety precautions. Improper handling could ignite the airbag and cause injuries.

Remove dashboard trim panel as before - refer to 31 45 180.

Remove steering wheel - refer to 32 32 000.
Disconnect plugs of wires leading to the steering column.

Remove collar ring (1).

Installation

Recess in collar ring (1) locks snap ring (2).



Remove ball.

Press down on steering spindle.

Installation

Ball must be located in locking groove of the steering spindle.
Replace self-locking nut.
Tightening torque*

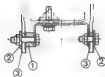


Unscrew bolts.

Installation

Replace self-locking nut.
Tightening torque*

* Refer to Specifications



32 32 030

- 1 Spacer
- 2 Washer
- 3 Steering lever



Installation
Insert spacer



Unscrew bolt.

Loosen both mounting nuts on bracket.
Press down and remove steering column.



Installation
Insert spacer
Tightening torque*

* Refer to Specifications

32 31 CHASSIS/ENGINE AND ASSEMBLING STEERING COLUMN ASSEMBLY

Remove steering column refer to [32 30 044](#)

Put on plug
Compress retainers and pull off switch.

Push retainers down using a screwdriver and remove starter switch.
Remove wire harness holder and relay socket.

Compress and pull out horn contact.

Installation
Lubricate lightly with grease in area of the spring.



Turn ignition key to "OFF"
Push Special Tool 32 3 110 or piece of 1.2 mm dia. wire into bore and pull out lock cylinder.



Lift out snap ring (1).
Remove washer (2), spring (3) and support ring (4).

Installation
Screw support ring (4) loose bearing.



Installation
Place snap ring (1) on Special Tool 32 3 052 and mount using Special Tool 32 3 051 (a rock from hammer).
Counterhold on steering spindle.



Chisel off shear-off screw.
Pull off steering lock.
If necessary knock out bearing.



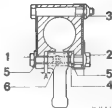


Installation
 Slide steering lock on to outer pipe.
 Tighten Torx screws until they shear off.

Lower Steering Spindle Bearing

Lift out snap ring (1) and remove collar ring (2) together with support ring (3).
 If necessary, knock out bearing.

Installation
 Stem of support ring (3) faces bearing.
 Mount snap ring using Special Tools
 32 3 051 and 32 3 052.



Unband lockplate (5).
 Unscrew bolts (1 - 3).

Bolt (1) = left hand threads.

Assembly Procedures (Conform with Sequence)

1. Screw in M 8 x 22 left hand thread bolt (1) together with lockplate (5).
 Tightening torque = 14 Nm.
 Check for distance A = 1.75 ± 0.05 mm between lever and stop.
2. Screw in M 8 x 28 bolt (2) together with lockplate (5) and nut (4).
 Tightening torque = 9 Nm.
3. Tighten nut (3).
 Tightening torque = 14 Nm.
4. Tighten hexagon nut (3) with lever (6) in "CLOSED" position.
 Tightening torque = 12 Nm.
5. Bend lockplate (5) to lock it.

32-31 DISASSEMBLING AND ASSEMBLING STEERING COLUMN AIRBAG ASSEMBLY (AIRBAG)

Remove steering column - refer to 32-31 090.



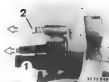
Drive out expansion nuts with help of a punch.
Remove upper section.



Pull off plug.
Compress retainers and pull off switch.



Press retainers down using a screwdriver and remove starter switch.
Remove wire harness holder and relay socket.



Compress and pull out horn contact (1) and lockpin (2).



Turn ignition key to "ON".
Press Special Tool 32-3 110 or piece of 12 mm dia. wire into bore and pull out lock cylinder.



Lift out snap ring (1).
Remove washer (2), spring (3) and support ring (4).



Precaution:
Clean up support ring (4) faces bearing.

Installation:
Place snap ring (1) on Special Tool 32-3 052 and mount using Special Tool 32-3 061 (knock from hammer).
Countersink on steering spindle.



Chisel off shear-off screw
Pull off steering lock
If necessary, knock out bearing

Installation:
Use new shear-off screw



Lower Steering Spindle Bearing

Lift out snap ring (1) and remove roller ring (3) together with support ring (2).
If necessary, knock out bearing.

Installation:
Insert support ring (2) into bearing
Mount roller ring using Special Tools
32 3 050 and 32 3 052

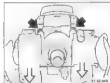


Manually Adjusted Steering Column

Unscrew screw and remove casing



Unscrew screw



Press switch housing out of steering column with pressure from both thumbs on the rollers.

Important:
Rollers will break off easily.



Unscrew ground lead.



Release both grub screws.

Installation note:
Secure grub screws with paint.



Remove steering angle sensor (1) with driver (2).

Installation note:
The pin of steering angle sensor (1) must be fitted in the armature (2).



Lever out snap ring (1) and remove together with support ring (2).



Installation note:
Fit support ring (1).
Pull snap ring (1) with special tool (2) = 090 and steering wheel retaining screw until it engages in groove of steering shaft.
Snap ring (1) can also be fitted with special tool 52 1 073.



Lever out steering shaft bearing and remove inner sleeve of bearing.



Installation note:
Fit inner sleeve of bearing with chamfered edge facing towards the steering rack.



Release shear-off screws.

Installation note:
Tighten shear-off screws until they shear.



Turn steering rack in position "B".
Press down steering shaft and remove steering rack.

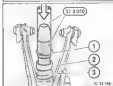


Installation
Lower pin must fit in bore.

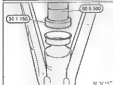


Upper Steering Spindle Bearing

Lift out snap ring (1) and remove support ring (2) together with spring (3).
Remove steering spindle.
Pull outer pipe out of console.

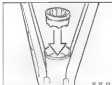


Installation
Install spring (2) and support ring (3).
Recess in support ring (3) must face snap ring (1).
Install snap ring (1) using Special Tool 32 3 670.

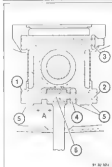


Knock steering spindle bearing out of outer pipe.

Installation
Press contact ring out of bearing.
Knock in bearing using Special Tools 32 1 150 and 32 5 508.



Coat metal lugs of contact ring with grease* and press contact ring into bearing.



Unscrew screw, press retainers towards outside and remove potentiometer.

Clamp Adjustment
Unbend lockplate (1).
Unscrew bolts (1 - 3).

Bolt (1) = left-hand threads.

Assembly Procedures (Conform with Sequence)

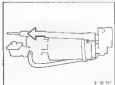
1. Screw in M8 x 32 left-hand thread bolt (1) together with lockplate (3).
Tightening torque = 10 Nm.
Check for distance A = 0.5 ± 1 mm between lever and clamp.
2. Screw in M8 x 40 bolt (2) together with lockplate (3) and nut (4).
Tightening torque = 7 Nm.
3. Tighten nut (4).
Tightening torque = 10 Nm.
4. Tighten hexagon nut (3) with lever (5) in "CLOSED" position.
Tightening torque = 10 Nm.
5. Bend lockplate (3) to lock it.

* Refer to Operating Fluids



Electrically adjustable steering column:
 Work is identical to mechanically adjustable
 steering column.

Unscrew bolts.
 Twist plug out of bracket.
 Remove transmission motor.



Remove shaft.



Unscrew bolts.
 Remove transmission.

32 32 001 REPLACING COMPLETE STEERING LOCK

Procedures are identical with those for
"Removing and Disassembling Steering
Column" in 32 32 000

32 32 170 REPLACING INTERLOCK CABLE

Procedures are contained in
32 32 001 (Replacing Steering Lock) and
25 18 (Removing and Installing Selec-
tor Lever - Interlock Version).

Check the function after installation as
before.

- 1 Move selector lever of automatic trans-
mission into "P".
- 2 Remove the ignition key.
- 3 Press the selector lever button.
- 4 If the selector lever can be moved out of
P, the interlock cable must be adjusted
- refer to Group 25.
- 5 Switch the ignition on.
- 6 Press the selector lever button.
- 7 If the selector lever cannot be moved
out of P, the interlock cable must be
adjusted - refer to Group 25.



32 32 000 REMOVING AND INSTALLING REPLACING STEERING LOCK CYLINDER

Turn the lock cylinder 60° to position "P"
with the ignition key.



Press Special Tool 32 3 110 or a piece of
1.2 mm dia. wire into the bore of the lock
cylinder and pull the lock cylinder out.



32-32-000 REMOVING AND INSTALLING STEERING WHEEL
- Without Airbag -

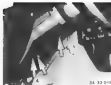
Use only Stahl'airbags.



Unscrew and remove nut (1) together with washer (2).
Mark position of steering wheel to steering spindle.
Pull off steering wheel - only possible after unlocking steering lock.

Attention!
Retighten self-locking but
Tightening torque*

Important!
Do not damage horn signal self-canceling cam.
Lubricate slip ring for horn with grease**



32-32-002



32-32-003

Pull plug (labeled) out of holder and disconnect it.



32-32-004

Unscrew screen (Torx T 30 socket).

Attention!
First tighten screw at right hand side on seen looking in forward driving direction.
Tightening torque*



32-32-005

Pull off plug and remove airbag unit.

Caution!
Airbag unit may only be fed aside with pad being up (in trunk).

Installation:
Do not pinch wiring.

* Refer to Specifications
** Refer to Operating Fluids

- With Airbag -

Caution!
Conform with safety precautions. Improper handling could ignite the airbag and cause injuries.

Disconnect battery and cover negative pole or terminal.
Uncover casing lower section.

* Refer to Specifications



Set steering wheel in straight ahead position (marks on steering gear and on steering shaft). Release nut/bolt and remove with washer.

Mark steering wheel with respect to steering column.

Caution!

If the steering wheel is secured by a nut, it can only be removed with the steering lock unlocked.



Adjust contact ring if necessary

Press down spring (1). Turn contact ring to left or right as far as it will go, turn back by approx. 3 turns, until marking arrives for center position again, release spring (1).

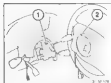


Installation note

Fit slip ring with grease**

- with wiring B

Remove steering wheel, refer to Repair Manual



Installation note

Lock pin (1) must engage in recess (2). Replace self-locking nut. Tightening torque* for nut or bolt.



Note:

The retaining spring (1) which holds the contact ring in center position exerts a force by loosening the nut/bolt.

On no account must the steering wheel be moved without the nut/bolt being tightened. The contact ring will be damaged!

* Refer to Technical Data

** Refer to Fluids and Lubricants Specifications

Function

The system is triggered by sensors which must detect vehicle retardation equivalent to a direct head-on collision at no less than 18 km/h with a stationary and rigid object (i.e. one which does not move on impact).

The electric circuit is made and gas generators are fired. At this point, through the instantaneous combustion of the solid fuel mixture, both inert gases are released which:

- a) fully inflate the folded airbags in the steering wheel and the dashboard panel within approx. 30 ms. (fully inflated), the airbag reduces the extent of injuries to head and upper torso in head-on collisions.

The bags are deflated by two holes in the side of the airbag opposite the driver.

- b) push down the piston (3) in the cylinder and tensions the safety belt by tightening a wire cable (2). The passenger is securely held against the backrest.

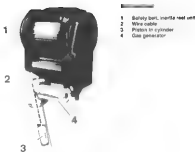
Monitoring

The airbag system is monitored continuously by a diagnostic unit from ignition lock position "1" on. The telltale lights up and goes out again after about 6 seconds. Airbag is approx. 6 seconds, indicating operational readiness of the system.

Constant flashing or continuous lighting of the telltale indicate the presence of a defect in the airbag system.

Self-diagnosis - fault-memory interrogation with BMW DIAGNOSIS SYSTEM

Airbag II troubleshooting, refer to Repair Manual, 3 Series E38



SAFETY RULES FOR HANDLING AIRBAG/BELT TENSIONER GAS GENERATORS

Non-conformance with these instructions could lead to unwanted activation of the system and injury.

Gas generators are pyrotechnical items. Handling, transporting and storing are subject to "legislation concerning explosive materials".

The specifications listed below are in reference to Germany. There must always be conformance with pertinent legislation in other countries.

1 Transporting

- 1.1 Gas generators must never be transported in passenger compartments.
- 1.2 Company level transportation must always be in the trunk or cargo room of a vehicle in packed state -- the quantity of units is limited to 50.

2 Storing

- 2.1 Max. permitted quantity of gas generators in one workshop is 20.
- 2.2 Storage of up to 200 units is permitted in a suitable and lockable room.
- 2.3 Gas generators must be stored in packaging suitable for transportation.

3 Installing and Removing

- 3.1 "Airbag" components and plugs can be recognised immediately on the orange color.
- 3.2 Tests and installation/removal may only be performed by personnel with qualified training in BMW service.
- 3.3 Working on the "Airbag system" always requires the battery to be disconnected, the negative pole or terminal to be covered and the "airbag" plug (steering column) to be disconnected.
- 3.4 If work on the system has to be interrupted, a gas generator must not be left unattended.
- 3.5 Components of the airbag system may not be repaired, but instead they must always be replaced.
- 3.6 Never treat "airbag" components with cleaning solutions or grease.
- 3.7 Never subject gas generators to temperatures above 100 °C.
- 3.8 Gas generators, crash sensors and electronic diagnosing units, which have fallen down from a height of 0.5 meters or more, cannot be installed in cars again.
- 3.9 The "Airbag system" may only be checked electrically installed in the car and only with a BMW Service Tester.
- 3.10 The airbag gas generator may only be laid aside with the padded side facing up, since if the generator were ignited with the airbag facing down, the generator would be catapulted up and could cause injury.
- 3.11 The ignition pin of a gas generator must never be aimed at persons regardless of the circumstances.

Procedure for Repairing and After Accidents

Always disconnect the battery (first interrogate fault memories as disconnecting the battery erases them). Cover the negative pole or terminal and disconnect both plugs for crash sensors in the engine compartment and plugs for the gas generators, to be sure that power supply to the gas generators is interrupted, prior to working on the body or wiring with an electric welder.

Also refer to other instructions in the repair manual.

After Accidents

If the airbag had been activated, always replace all components with exception of wiring when not damaged.

32-34/4

4. Scrapping "airbag" vehicles

Airbag inflator assemblies, which have not been triggered pose a danger (also for the environment)

■ According to relevant accident prevention regulations, "airbag" inflator assemblies must be dismantled and made inoperable before scrapping. This is necessary since pyrotechnic components can cause injuries if activated incorrectly (e.g. recapping with cutting torch).
"Airbag" inflator assemblies in the vehicle to be scrapped must be fixed with the doors closed from the outside. The ignition device with corresponding cables developed by BSH should be used for this purpose.

Caution!

The burning solid fuel causes the airbag unit to heat up - risk of burn injuries!

Wash hands after touching ignited inflator assemblies!

■ Driver's airbag up to model year '84

- 1 Remove bottom section of steering column shroud and disconnect plug connection (orange) to airbag unit.
- 2 Connect ignition device B2 1 270 to plug connector, use cable B2 1 280 or B2 1 233 if necessary.
- 3 Connect ignition device to a 12 V battery (10 m distance from vehicle).
- 4 Keep distance from vehicle corresponding to length of ignition cable - location always in front of vehicle (this also applies to all other persons).
- 5 Press switch on ignition device - airbag inflates.

■ Driver's airbag with indicator lamp integrated in steering wheel

- 1 Remove airbag unit from steering wheel.
- 2 Disconnect plug connector from airbag unit. Connect cable B2 1 280 and connect to ignition device B2 1 270.
- 3 Dismantle airbag unit.
- 4 Connect ignition device to a 12 V battery (10 m distance from vehicle).
- 5 Maintain distance from vehicle corresponding to length of ignition cable - location always in front of vehicle (this also applies to all other persons).
- 6 Press switch on ignition device - airbag inflates.
- 7 Remove airbag unit. Caution: Airbag unit is hot! Danger of burn injury! Disconnect cable.

■ Belt tensioner up to model year '83

- 1 Insert plug-in bracket in belt buckle. If this is no longer possible, the plug-in bracket must be pushed as far as the outlet opening in the B-pillar.
- 2 Mark seat belt strap with a chalk line at the outlet opening of the B-pillar so that way it is possible to check the belt tension after ignition.
- 3 Disconnect plug connection to belt tensioner of airbag control unit.
Installation location of airbag control unit: LH side under instrument panel etc.
- 4 Connect ignition device B2 1 270 together with cable B2 1 280 to the plug connector.
- 5 Connect ignition device to a 12 V battery (10 m distance from vehicle).
- 6 Maintain distance from vehicle corresponding to length of ignition cable - location always in front of vehicle (this also applies to all other persons).
- 7 Press switch on ignition device - belt tensioner tightens.

4. Vehicles as of model year '84 (driver's front passenger's airbag and belt tensioner if applicable)

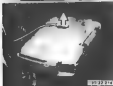
- 1 Disconnect plug connector from airbag control unit.
Installation location of airbag control unit: Under rear seat.
- 2 Connect ignition device B2 1 270 together with cable B2 1 280 to the plug connector.
- 3 Connect ignition device to a 12 V battery (10 m distance from vehicle).
- 4 Maintain distance from vehicle corresponding to length of ignition cable - location always in front of vehicle (this also applies to all other persons).
- 5 Press switch on ignition device - all inflator assemblies ignite.



32-32 115



32-32 116



32-32 118

32-34 119 REMOVING AND INSTALLING OR REPLACING AIRBAG UNIT

Caution*

Conform with safety regulations.
Improper handling could cause activation of the airbag and lead to injuries.
Disconnect battery and cover the negative pole or terminal.

Unscrew casing lower section.

Pull (brangel) plug out of the holder and disconnect.

Unscrew screws with Special Tool
32-3 119.

Installation

First tighten bolt on right-hand side as seen looking forward in car.
Tightening torque*

Pull off plug and remove the airbag unit.

Caution*

Place airbag unit aside (in trunk) with the padded side facing up.

Installation

Don't pinch the electric leads.

* See Specifications

32-34 506 Additional work with front passenger's airbag Steering wheel removed -

Caution!

Observe safety instructions!
 Incorrect handling can result in the airbag
 triggering thus causing injuries.



L/R out covering



Release connector



Disconnect plug connectors and remove front passenger's airbag.

Place front passenger's airbag with padded cushion facing upward (luggage compartment).

Installation note
 Do not trap cables.

32 34 515 REPLACING CONTACT RING (AIR BRAKE)

Caution

Comply with safety regulations.
Improper handling could lead to activation of
the airbag and lead to injuries.
Remove steering wheel - see 32 33 000

Pull off casing

Installation:
Substitute slip ring for horn with grease

Mark position of circlip to hub.
Unscrew three studs.

Press down, turn and remove the circlip.

Installation

Insert, turn and pull up circlip in hub.
Studs must be in openings of the circlip.



Left out the hub with a contact ring

Installation:

Place spring on the lock and insert in bore.
Press down on lock until it engages.



Disconnect plug

Unscrew nuts and take off the contact ring

Important

A new contact ring is fixed in center position
by a screw.
This screw must be removed after bolting the
contact ring on the steering wheel



32 33 010



32 32 000



32 32 010



32 32 020



85.77.010 Removing and installing or removing airbag diagnosis unit

Caution

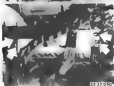
Observe safety regulations!
Incorrect handling can activate the airbag and lead to injuries.

Disconnect battery and cover ground pole or terminal.

Remove lower section of trim. Remove plug connection (orange) from bracket and disconnect.



Press plug connection off bracket. Unscrew



Unscrew bolts

Disconnect plug connections (orange).
Remove diagnosis unit.



Arrow (a) unit shows direction of travel.

85.77.012 Removing and installing or replacing control unit for Airbag I

Refer to Repair Manual for J Series E36.

65 77 015 Replacing capacitor in airbag diagnostic unit

Diagnostic unit 65 77 010



Open cover with foster gauge (6-20 mm) or a small screwdriver

Installation note
Install new cover

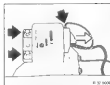
Release screws and remove capacitor

Installation note
Clean contact surfaces

65 77 016 Removing and installing basic/central airbag unit

Caution:

Observe safety instructions!
Incorrect handling can cause the airbag to trigger thus causing injuries.
Disconnect battery and cover negative terminal



Remove rear side, refer to 65 00 010.

Release screws, disconnect cable plug connector and remove basic/central airbag unit

Arrows on unit point in forward direction

65 77 018 Replacing basic/central airbag unit

Removing and installing basic/central airbag unit, refer to 65 77 016.



32 32 003

88 77 020 REMOVING AND INSTALLING OR REPLACING ONE AIRBAG SYSTEM

Caution!

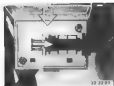
Complies with safety regulations.
Improper handling could cause activation of
the airbag and lead to injuries.
Disconnect battery and cover negative pole
on terminal.
Unscrew casing lower section.
Pull connector plug out of holder and
disconnect.

Disconnect plug and unscrew casing with
Special Tool 00 2 110
Installation
Arrow on sensor faces forward
Tightening torque *

88 TO 845 REPLACING AIRBAG SAFETY SWITCH

Caution!

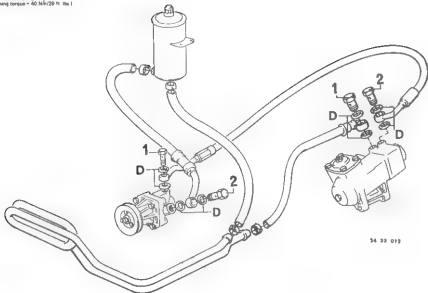
Conform with safety regulations.
Improper handling could cause activation of
the airbag and lead to injuries.
Disconnect battery and cover negative pole
or terminal.
Open the cover, remove plug and unscrew
screws.
Note:
Opening the cover destroys the safety
pinch, which must then be replaced.

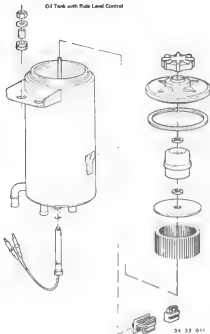
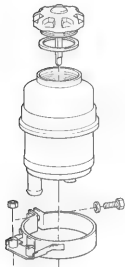


Turn on safety switch.
Install plug.
Slide contact sleeve on plug.
Close cover.

Power Steering Layout Drawing

D = O-ring

1 = M 16 hollow coupling bolt
(tightening torque = 35 Nm/26 ft. lbs.)2 = M 18 hollow coupling bolt
(tightening torque = 40 Nm/29 ft. lbs.)



32 41 000 CHECKING FUNCTION OF

Check all hose connections, pump and steering gear for leaks before testing.

1. **Checking Power Steering Pump**
Connect pressure tester between pump and steering gear.



32 4 000

32 01 010



32 4 000

32 01 010

- 1 - Pump connection
- 2 - Steering gear connection

- A - Shut-off valve (low pressure)
0 to 15 bar (0 to 212 psi)
- B - Shut-off valve (high pressure)
0 to 150 bar (0 to 2132 psi)

Shut valve (A)
Open valve (B)
Start engine.
Correct hydraulic fluid level** in tank.

Shut valve (B) max. 10 seconds and read pressure.
The rated pump pressure¹ must be reached within $\pm 10\%$.
If the rated pressure¹ is exceeded, replace power steering pump - see 32 43 00-1.
If the rated pressure¹ is not reached, check drive belt tightness - see 32 41 100.
Repeat test.
If the rated pressure¹ is still not reached, replace power steering pump - see 32 41 00-1.

¹ See Specifications.

² See Operating Fluid Specifications.



2. Checking Power Steering

Pressure tester connected between pump and steering gear, system bleed, valve (B) opened, valve (A) shut, engine not started.

Left side

Stop steering from reaching final left lock to 1/2 to 3/4 steering wheel turn with a guide of road or something similar.

Start engine.

Put steering wheel against final left lock with a force of 100 N (22 lbs 10-oz force) about 5 seconds and read pressure.

Leave final right lock and repeat test on right side.

If pressure valve too low (than pump pressure determined in point 1) replace steering gear seal (32 00 000).



3. Checking Mechanical Play of Steering
 - Pressure point adjusted - see 32 13 014.
 No play in steering column.
 Pressure tester between pump and steering wheel.
 ■■■■
 System bleed
 Open valve (B)
 Shut valve (A)
 Engine not started.
 Hold steering drop arm in straight ahead position with Special Tool 32 4 000.



Turn steering wheel counter-clockwise until pressure tester shows 1 bar (14 psi) more pressure than the flow pressure value.
 Mark position of steering wheel hub.
 Repeat this in clockwise direction.
 If max. permissible lateral (C) + 7 mm (0.276") is exceeded, replace the steering gear set.
 ■■■■

Remove special tool holder and pressure tester.
 Bleed hydraulic system and, if necessary, add hydraulic fluid**.

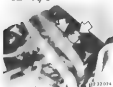


Place strips of paper on the steering wheel hub and raising upper section.
 Make mark (center) on steering wheel hub.



Start engine.
 Open valve (A).
 Read flow pressure.

** See Operating Fluid Specifications



32 41 004

32 41 005 REMOVING AND INSTALLING POWER STEERING PUMP

Drain hydraulic fluid out of tank — never reuse it!
Unscrew pipes

and replace them
Replace gaskets
Tightening torque*
Bleed hydraulic system — refer to 32 43 006



32 43 008



32 41 011

M02, M21
Loosen nut (1) and slacken drive belt by turning toothed element (2)

Unscrew bolts and remove power steering pump

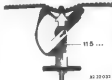
Important!
Adjust drive belt tension prior to tightening the bolts.

M02
Loosen bolts (1)
Loosen nut (2) and turn tensioning pinion
Remove bolts (1)

* Refer to Specifications



32 43 006



32 43 007

Installation
Adjust drive belt tension prior to tightening the bolts.
Tensioning pinion to approx. 8 mm and tighten nut

Check drive belt tension using Special Tool (1)
Hook bears on tip of tooth

Important!
Ensure sufficient clearance between hoses and body parts, making corrections on hose connections if necessary

M02, M21
Remove ribbed drive belt — refer to Group 11 and 12
Unscrew pump oil pan

INFO

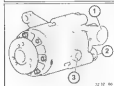
If applicable, remove splash guard.
Remove ribbed drive belt - refer to Gr. 11

Disconnect pipes.

**Power Steering Pump**

Installation
Replace gaskets.
Tightening torque*
Bleed hydraulic system - refer to 32 43 008

- 1 To steering
- 2 To tank

**Spooler Pump**

Installation
Replace gaskets.
Tightening torque*
Bleed hydraulic system - refer to 32 43 008

- 1 To steering
- 2 To tank
- 3 To side level height control

**Unloader Nut (3)**

Installation
Mount support (1) on pump to specified tightening torque*
Screw nut (2) against engine carrier head tight.
Tighten nut (3) to specified torque*

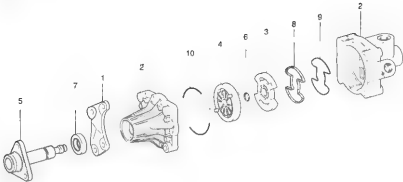


Unloader oil pump to all part bolts and remove pump

Tighten up
Tightening torque*

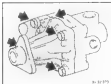
POWER STEERING PUMP

- 1 Holder
- 2 Body
- 3 Face plate
- 4 Rotor
- 5 Shaft
- 6 Snap ring
- 7 Radial oil seal
- 8 Seal
- 9 Guide
- 10 O-ring



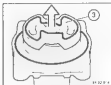
32-41/83 DISASSEMBLING AND ASSEMBLING POWER STEERING PUMP Pump Removed

**Absolute cleanliness is essential when work
ing on pumps.**



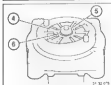
32-41/83-1

**Mark position of holder (1) re-pump body (2)
Unscrew bolts and separate the body**



32-41/83-2

Take off face plate (3)

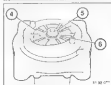


32-41/83-3

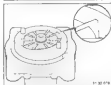
**Press down rotor (4) on shaft (5)
Remove casing (6) and pull shaft out of body
Remove rotor (4) with the impellers**



32-41/83-4



32-41/83-5



32-41/83-6



32-41/83-7

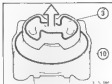
Assembling:

**Clean and lubricate all parts with hydraulic
fluid.
Replace radial oil seal (7) setting lip back
in - and push space between sealing and shaft
lips with grease.**

**Insert shaft (5) in body
Mount rotor (4) with notes for snap ring
flaring up and install snap ring (6) in radial
groove of the shaft**

**Install the impeller with the polished,
rounded outside surfaces facing the cam ring.
Check that impeller moves easily**

**Install seal (8) with grease and facing down
and guide (9) in face plate (3)**



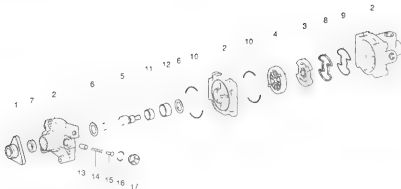
Install Face plate (3) on device port
Replace O-ring (10)



Mount body (checking the bones are aligned)
and bolt down with the Torx
Tightening torque = 10 to 12 Nm (12 to 14
ft. lbs.)

Check function after installation of the
power steering pump

TALDEW PUMP LAYOUT (DRAWING)



D = 3p (160)

- 1 Flange
- 2 Body
- 3 Pack plate
- 4 Rotor
- 5 Shaft
- 6 Axial washer

- 7 Radial oil seal
- 8 Seal
- 9 O-ring
- 10 O-ring
- 11 Sleeve
- 12 Slide

- 13 Piston
- 14 Spring
- 15 Shaft
- 16 O-ring
- 17 Plug

32-41 DISASSEMBLING AND ASSEMBLING TANDUM PUMP – Pump Flanged

Important disclaimer is requested when assembling the pump.
Lubricate all parts with hydraulic fluid



Mark position of flange to shaft and body sections to each other
Unscreen bolts
Take off body



Unscreen bolts
Take off body (40)



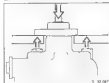
Replace seal (18) with end facing plate and guide (19)



Replace O ring (10)
Bolt body – torque to spec.
Tightening torque = 14 + 5 Nm (10 + 4 ft.lbs.)



Unscreen bolt (17)
Take off piston and sliding ring with sleeve



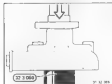
Press triangular flange off of the shaft with a press, while supporting on the flange



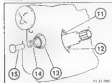
Replace seal on seal (7) setting the facing up and filled with grease



Insert axial washer (8) and run in shaft (5).



Press on Bore with Special Tool
32 3 000
Shaft protrusion = approx. 1 mm
(0.039").
Check marks.



Insert sleeve (11) and sliding ring (12)
5 hole in both pistons (13), spring (14)
and shaft (15).



Replace O-ring (16)
Tighten plugs (17) with a torque of
50 Nm (36 ft. lbs.)

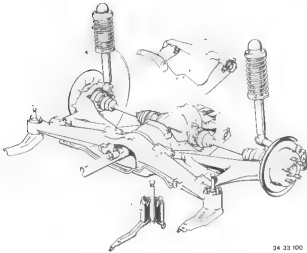


Replace O-ring (10)
Insert axial washer (8)
Mount and bolt body
Tightening torque = 8 Nm (5 ft. lbs.)

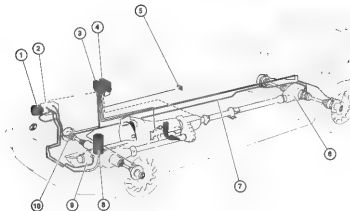
Other jobs – see 32 41 553

33 Rear axle

	Rear axle – layout drawing E34 (excluding 520i 524td)	33-	0/1
	Rear axle – layout drawing (four wheel drive)	33-	0/2
	Breaking-in procedures after replacing/repairing final drive	33-	10/1
33 10 010	Rear axle final drive – remove and install (525i M5/Four wheel drive)	33-	10/2
010	Rear axle final drive – remove and install (520i 524td)	33-	10/3
33 11 151	Shaft seal for drive flange – replace	33-	11/1
151	Shaft seal for drive flange – replace (E34 Four wheel drive)	33-	11/2
33 17 001	Rubber mounts for final drive (rear axle carrier) – replace	33-	17/1
006	Rubber mounts for final drive (front and rear) – replace	33-	17/2
33 19 000	EHI limited slip differential – check function	33-	19/1
010	EHI limited slip differential – bleed	33-	19/2
	Hydraulic system leak test	33-	19/2
050	GSA control unit – remove and install or replace	33-	19/3
100	EHI limited slip differential hydraulic control unit – remove and install or replace	33-	19/4
	Pressure reservoirs – check pressure	33-	19/5
	Pressure reservoirs – remove and install or replace	33-	19/7
33 21 000	Output shaft – remove and install	33-	21/1
031	Boot – replace	33-	21/1
33 31 000	Rear axle carrier, complete – remove and install	33-	31/1
	Arrangement of control arm 13" – axle	33-	32/1
33 32 000	Control arm – complete – remove and install	33-	32/2
021	Control arm – replace	33-	32/3
561	Both rubber thrust mounts – replace	33-	32/3
	Toe-in modification on left wheel	33-	32/5
	Toe-in modification on right wheel	33-	32/6
33 33 071	Rubber mount for rear axle carrier – replace	33-	33/1
001	Thrust rod – replace	33-	33/3
33 41 151	Wheel bearing and shaft seals – replace	33-	41/1
33 52 100	Spring strut shock absorbers – rear left or right, complete – remove and install	33-	52/1
131	Spring strut shock absorber, rear left or right – replace	33-	52/2
	Arrangement of spring strut at rear	33-	52/3
33 53 000	Coil spring – rear left or right – install	33-	53/1
	Rear axle – troubleshoot	33-	90/1



FOUR WHEEL DRIVE LAYOUT DRAWING



- 1 Pressure reservoir
- 2 Hydraulic control unit
- 3 ABS control unit
- 4 GSA control unit
- 5 Fault-control lamp

- 6 Rear axle final drive with EH lock
- 7 Hydraulic pipe to rear axle final drive
- 8 Hydraulic fluid tank
- 9 Hydraulic fluid pump
- 10 ABS sensor

BREAKING IN PROCEDURES AFTER REPLACING REPAIRED REAR AXLE FINAL DRIVE

Strict conformance with these breaking in procedures is required for preloading the tapered roller bearing.

During the first 1,000 kilometers the car must be driven at different engine speeds and road speeds, but never faster than 3/4ths of the max. permissible speed.

If there is no conformance with these breaking in procedures, there could be contact between the tapered rollers and inner race guide band which in turn will cause continuous noise, overheating and oil leakage.

Install a tag or label to remind the driver of the next oil change.

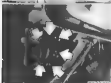


33-10 010 REMOVING AND INSTALLING REAR AXLE FROM DRIVE -RWD- 4x4 Four Wheel Drive-

Unscrew the propeller shaft at the rear axle refer to Group 75

Installation

Replace the anti-locking nuts Tightening torque*



Unscrew and support the output shaft from the car on pieces of wire

Installation

Tightening torque*

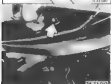


Rear axle Final Drive with EH Lock

Unscrew the hydraulic pipe and plug the opening with a suitable cap.

Installation

Tightening torque*
Wipe the EH locked slip differential refer to 33-10 010



Unscrew the rear axle final drive bolt at the front end of the rear axle carrier

Installation

First secure the rear axle final drive on the rear axle carrier with the front bolts. Tightening torque*



Put the electric wire plug off of the speed sensor pulser gander after squeezing both rear wheels.
Put the transmission and plug out of the holder



Support the rear axle final drive from underneath using a garage jack and Special Tool 33-4-290

Unscrew the left and right rubber mount bolts and lower the rear axle final drive.

Installation

Tightening torque*
Check the oil level and, if necessary, add rear axle final drive gear lube**



Note

When replacing the final drive, note the final drive ratio and version.
Ratio and version are die-stamped in data plate (1).

* Refer to Specifications

* Refer to Specifications
** Refer to Operating Points



33-10 010 REMOVING AND INSTALLING REAR AXLE FINAL DRIVE • 500i and 524td

Uncrew the propeller shaft at the rear axle
refer to Group 25.

Installation
Replace the seal locking nuts.
Tightening torque*



Unscrew and suspend the output shafts
from the car on pieces of wire.
Unscrew reinforcement strut (1).

Installation
Use washers.
Tightening torque**



Unscrew the bolts at the top of the rear
axle carrier.

Installation
Tightening torque*



Support the rear axle final drive from under-
neath using a garage jack and Special Tool
33-4 090.

Unscrew the front bolts.

Installation
Tightening torque*



Put the electric wire plug off of the speed-
ometer pulse sender after squashing both
retainers.

Unscrew the rubber mount bolt and lower
the rear axle final drive.

Installation
Tightening torque*
Check the oil level and, if necessary, add
rear axle final drive gear lube**



Note
When replacing the final drive, note the
bearing number.
Ratio and version are die-stamped in data
plate.

* Refer to Specifications

* Refer to Specifications.
** Refer to Operating Fluids

33 11 011 Replacing shaft seal and
output flange of rear axle
differential (Type R/M/D)

Refer to Repair Manual 7 Series E20

33 11 021 Replacing shaft seal for
output flange of rear axle
differential

Refer to Repair Manual 7 Series E20 for differ-
ential Type G and H

Refer to Repair Manual 7 Series E20 for differ-
ential Type H and K



33-11-0-5



33-11-0-6



33-11-0-7

33-11-151 Replacing shaft seal for drive flange

Disengage output shaft from drive flange and be back.

Installation note:
Install shims.
For tightening torque!

Press out drive flange with crowbar

Installation note:

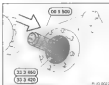
Replace stretched round wire snap rings.
Before mounting the drive flange, fit the round wire snap ring (1) in the groove of the differential casing such that both ends of the round wire snap ring are sunk in the groove.
This prevents the ring being bent to the side.
Press on drive flange by hand and by turning slightly until the round wire snap ring can be heard to engage.

* Refer to Technical Data



Remove shaft seal with special tool 00 5 500 and suitable thrust plate.

Clean casing flange and seating rim of shaft seal with differential gear oil



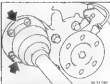
P. 33 3027



P. 33 3028

Drive in shaft seal as far as it will go with special tool 00 5 500/33 3 440 (power with 8 bolts) or 33 3 420 (cover with 8 bolts).

Drive in shaft seal as far as it will go with special tool 00 5 500/33 3 440 (power with 8 bolts) or 33 3 420 (cover with 8 bolts).



33 11 101 REPLACING SHAFT SEAL FOR DRIVE FLANGE - ESA Four Wheel Drive -

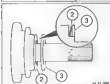
Unscrew the output shaft of the rear axle final drive and suspend it from the car on a piece of wire.

CRITICAL
Use washers
Tightening torque"

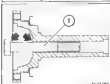


Left Flange

Mount Special Tool 33 2 140 on the drive flange with (1)th bolt and unscrew bolt (1). Put the drive flange out and ensure that the bearing housing washers and needle bearing do not fall out.



Installation
Insert diaphragm spring (2) and bearing thrust washer (3) on the flange prior to installation of the drive flange. Press the drive flange in by hand and with slight turning.



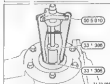
Installation
Replace bolt (1).
Clean the bearing surfaces between the bolt head and drive flange (bearing surface) thoroughly.
Tighten the bolt using Special Tool 33 1 190.
Tightening torque"

" Refer to Specifications

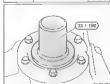


Take needle bearing (4) and thrust washer (5) out of the bearing cap.

Installation
Dip the needle bearing and thrust washer in rear axle final drive gear tube prior to installation.
Ensure absolute cleanliness.



Apply Special Tools 33 1 306 and 33 1 308 and pull the shaft seal out using Special Tool 33 1 310.



Dip the new shaft seal in rear axle final drive gear tube.
Knock the shaft seal in as far as the stop using Special Tool 33 1 195.



Right-hand flange

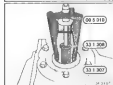
Secure special tool 33 3 148 with three bolts in drive flange and release bolt (5).
Pull out drive flange.



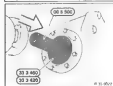
Installation note

Press in drive flange by hand while turning slightly.

Thoroughly clean contact surfaces between bolt head and drive flange (sealing surface).
For tightening torque*



Fit thrust plates 33 3 307 and 33 3 308 and remove shaft seal with Special Tool 90 3 010.



Installation note

Clean mating flange and seal lips of shaft seal with differential gear oil.
Installation note:

Drive in shaft seal as far as it will go with special tool 90 3 010-33 3 480 (cover with 4 bolts) or 33 3 430 (cover with 6 bolts).

* Refer to Technical Data

33-17 001 REPLACING RUBBER MOUNT

REAR AXLE CARRIER
(REAR AXLE CARRIER)

Pull the electric wire plug off of the speedometer pulse sender.
Support the rear axle final drive from underneath with a garage jack.



Unscrew the bolts and lower the rear axle final drive.

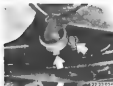
Installation
Tightening torque*



Unscrew the bolts and remove the rubber mount.

Installation
Clean the threads and install the bolts with LOOSE.
Tightening torque*

* Refer to Specifications.



33 17 026 REPLACING ALL RUBBER MOUNTS FOR REAR AXLE (FRONT, DRIVE (FRONT) AND REAR)

Remove exhaust assembly - refer to 33 10 010

Remove the rear drive

Remove rear axle from drive - refer to 33 10 010

Unscrew the propeller shaft at the center mount and lower



Pull the rear rubber mount out using Special Tools 33 3 142, 33 3 141 and 33 3 144



Coat new rubber mounts with Circolight[®] and install using Special Tools 33 3 142 and 33 3 141



Pull the rubber mounts in both using Special Tools 33 3 141 and 33 3 144



Unscrew the exhaust suspension hanger
Pull the front rubber mount out using Special Tools 33 3 142 and 33 3 144



Use Special Tool 33 3 141 for pulling out



Coat the new rubber mount with Circolight[®] and install from outside using Special Tools 33 3 141 and 33 3 144

Counterhold on inside with Special Tool 33 3 142 for pulling in

• Source of Supply: BMW Parts

• Source of Supply: BMW Parts

33-19-000 - CHECKING FUNCTION OF EH LIMITED SLIP DIFFERENTIAL**Note:**

This test is provided only for the sake of checking the entire electric/hydraulic (EH) locking system with single means.

First ensure that the electromechanical (EM) lock functions before checking the EH lock.

EM lock function test - refer to Group 37

Drive the car onto a lifting platform and raise the platform until all four wheels have cleared ground.

1 - Checking Free Movement of Limited Slip Differential

Switch the ignition off.

Release the parking brake lever.

Engage first gear or move the selector lever into P.

Turn the left rear wheel by hand, whereby the right rear wheel must turn in opposite

direction.

Note:

When the rear wheels can only be turned in opposite directions very difficultly or not at all, this is indication that the lock does not open.

Possible Faults:

- 1 - Mechanical fault in the limited slip differential
 - 2 - Pressure is not discharged in the hydraulic pipe to the limited slip differential.
- Troubleshooting - refer to diagnosis.

2 - Checking Locking Effect**Requirement**

Parking brake adjusted correctly

Remove the dust cover from the parking brake lever.

Pull the parking brake lever up 8 or 9 teeth.

Shooten the parking brake cable of the right rear wheel, until the wheel can be turned easily.

Engage first gear or range D.

Both front wheels and the right rear wheel must turn in forward direction.

The left rear wheel remains locked by the parking brake.

Caution:

Do not carry out the following test longer than 5 seconds as otherwise the parking brake would be subjected to excessive loads.

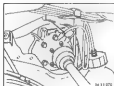
Increase the engine speed to 1500 - 2000 rpm and observe the left rear wheel.

The EH lock is okay, if the left rear wheel is turned in forward direction against the braking effect.

33-19-010 BLEEDING EX LIMITED SLIP DIFFERENTIAL

Note

Carry out the bleeding procedures via diagnosis.



Set up the bleeder hose with bottle on the bleeder screw of the rear axle final drive. Start the engine.
Loosen the bleeder screw slightly and begin with the bleeding procedures.

Flush the hydraulic system until bubbleless hydraulic fluid runs out (flushing volume approx. 300 cm³).

Tighten the bleeder screw.
Tightening torque*

Note

Remove any escaped Petroleum from the surface of the rear axle final drive after bleeding.

Check for leaks: refer to 33-19

Check and, if necessary, correct the hydraulic fluid level in the supply tank: refer to Group 33

33-19 CHECKING HYDRAULIC SYSTEM FOR LEAKS

Carry out the test test via diagnosis.

Leak Test

- Begin the bleeding procedures with the engine running
- Check connections of the hydraulic system for leaks, especially the hydraulic pipe between the hydraulic control unit and EX limited slip differential

* Refer to Specifications

33-19 000 REMOVING AND INSTALLING REPLACING GSA CONTROL UNIT

Caution!

Always switch the ignition off before re-
moving or installing the control unit.



Unscrew the screws.
Remove the cover.



Unplug and pull plug (1) off of the control
unit.
Pull the retainers out and remove the con-
trol unit.

33 19 100 REMOVAL AND INSTALLATION : REPLACING HYDRAULIC CONTROL UNIT FOR R/L LIMITED SLIP DIFFERENTIAL

Align

Bleed the hydraulic system. Refer to
33 19 010.

Switch the ignition off.



Discharge the pressure reservoir on the
hydraulic control unit by connecting a
bleeder bottle to the pressure discharging
to rear and loosening the screw carefully.

Caution!

If the pressure discharging screw is un-
screwed too fast, the bleeder hose could
pop off due to the high oil pressure (180
bar).

Wear protective goggles.

Installation

Tightening torque*



Unscrew hydraulic pipes (1 - 4) and insert
suitable caps into the openings.

Important!

Don't mix up the hydraulic pipes.

- 1 (T) return pipe to supply tank
- 2 (A) circulating connection (supply tank,
side level height control)
- 3 (P) feed pipe from hydraulic fluid pump
- 4 (R) feed pipe to rear axle final drive

Don't start the engine as the pipe to the
pump is disconnected.

Installation

Tightening torque*



Unhook and pull plug (5) off.

Unscrew the screws and remove the hydraulic
control unit.

Note

Don't start the engine when the hydraulic
control unit is disconnected, as the four-
memory would be activated.



Unscrew the screws and remove the heat
shield.

* Refer to Specifications.

* Refer to Specifications.

33-19 CHECKING GAS CHARGE PRESSURE IN PRESSURE RESERVOIR

Switch off engine



Disconnect the pressure reservoir on the hydraulic control unit by connecting a bleeder bottle to the pressure discharging screw and loosening the screw carefully.

Caution

If the pressure discharging screw is unscrewed too fast, the bleeder hose could pop off due to the high oil pressure (180 bar).

Wear protective goggles.

Installation
Tightening torque*



Connect a pressure tester to the hydraulic control unit.

Special Tools 34-3 101 102 103 104 105 106 and 107

Read value (1)

Start the engine and wait until 140 to 160 bar pressure is built up.

Stop the engine.

Connect pipe (3) to a bleeder bottle or place it in the supply tank.

Open valve (1) far enough that the pressure drops slowly while observing the pressure tester gauge.

The pressure at which the needle instantaneously drops to 0 bar is the gas charge pressure of the pressure reservoir.

Note

Repeat the test to double-check.

If the measured pressure is less than the minimum gas charge pressure*, the pressure reservoir must be replaced.



Unscrew the pressure discharging screw

* Refer to Specifications

Remove the pressure tester.
Install the pressure discharging screw.
Tightening torque*

* Refer to Specifications

Flushing Hydraulic Control Unit

Start the engine and wait (approx. 30 sec.) until pressure is built up.

Stop the engine.

Activate the pressure build-up valve as often (2 or three times) as diagnosis (component activation) until flow noise from the hydraulic control unit is no longer heard.

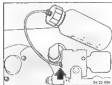
Important!

There must only be activation one time per minute.

Check and, if necessary, correct the oil level after finishing the work - refer to Group 33.

33 19 REMOVING AND INSTALLING REPLACING PRESSURE RESERVOIR

Switch the ignition off



Discharge the pressure reservoir on the hydraulic control unit by connecting a bleeder bottle to the pressure discharging screw and loosening the screw carefully

Caution*

If the pressure discharging screw is unscrewed too fast, the bleeder bottle could pop off due to the high oil pressure (~180 bar).

Wear protective goggles.

Installation

Tightening torque*



Loosen the pressure reservoir using Special Tool 33 2 080 and unscrew it

Installation

Screw a new pressure reservoir in. Tightening torque*

* Refer to Specifications

Pushing Hydraulic Control Unit

Start the engine and wait (approx. 30 sec.) until pressure is built up.

Stop the engine

Activate the pressure build-up valve as often (2 or 3 times) via diagnostic (compressor activated) until flow noise from the hydraulic control unit is no longer heard

Important!

There must only be activation one time per minute.

Check and, if necessary, correct the oil level after finishing the work - refer to Group 32



33-21-000 REMOVING AND INSTALLING OUTPUT SHAFT

Undo rear output shaft on final drive and rear axle shaft

Installation

Install washers on transmission and rear axle ends
Tightening torque*



33-21-011



Press output shaft out of constant velocity joint.

Important

Bearing inner race must bear on counterpressure plate (P)
Don't disassemble the joint.
Check joint for fit or damage.



33-21-012

* See Specifications



33-21-013

Mount dust cover with inside cover on the output shaft.
The joint must be positioned with the inner race collar facing the output shaft.

Important

Use a repair kit.
Dust cover is mounted on the cover



33-21-014

Remove grease from splines of joint
Coat splines with Lactite No. 379

Important

Keep Lactite out of ball grooves.



33-21-015

Press on joint with cap and metal ring (p).

Installation

If only one end is disassembled, the sealing cover on the other end must be removed to press on the joint.



33-21-016

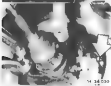
Fill joint and dust cover with grease*
Remove grease from sealing surface for the dust cover
Mount dust cover with a new strap.
Seal the sealing cover with Curti K2** and install.

* See Specifications
** Source of Supply: HWG



33 31 000 REMOVING AND INSTALLING REAR AXLE CARRIER ASSY

Remove exhaust assembly - see 15.00 030
Remove propeller shaft - see 26 11 000
Disconnect brake cables on parking brake lever - see 34 41 000
Draw off brake fluid in tank with a syringe reserved exclusively for use with brake fluid
Remove the load housing for this purpose



Insulation
P with brake fluid** and bleed brakes

Unplug right brake pad wear indicator
Disconnect ground lead and fit lead out of clamps



Put down connecting plug for both pulse senders and 4 connected.

Insulation
Don't destroy the rubber grommet



Put brake cables out of guides.
Unscrew left and right brake lines.

Insulation
Tightening torque*

* See Specifications
** See Gr 54 of Operating Fluids



Disconnect plug on speedometer pulse sender, squeezing both tabs together for this purpose
Remove holder



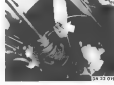
Support final drive with a workshop jack
Unscrew left and right thrust struts on the floor plate

Installation
Replace self-locking nuts.
Tightening torque*



Unscrew rear mounting bolt

Insulation
Tightening torque*



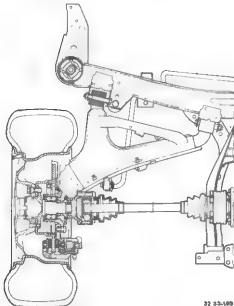
Unscrew left and right shock absorbers on trailing arms.
Lower the rear axle carrier

Insulation
Tighten mounting bolts with the car in normal position**
Tightening torque*

Put car and pull out complete rear axle carrier

* See Specifications
** See Specifications of Gr. 32

TRAILING ARM LAYOUT DRAWING
12° Trail Angle



33 32 006 REMOVING AND INSTALLING TRAILING ARM ASSEMBLY

Remove rear wheel - see 33 10 300.
Pull up parking brake lever and unscrew output shaft on the drive flange, suspending it from the car on a piece of wire.

Installation
Tightening torque*

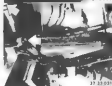
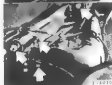
Remove brake cable on parking brake lever - see 34 41 000.
Draw off brake fluid in tank with a syringe reserved exclusively for use with brake fluid.
Remove float housing for this purpose.

Installation
Pour in brake fluid** and bleed brakes - see 34 50 040.

Pull down and disconnect plug for pulse sender.

Important!
Don't destroy the rubber grommet.

* See Specifications
** See Operating Fluids



Pull parking brake cable out of guide.
Disconnect brake line.

Installation
Tightening torque*

Support trailing arm from underneath.
Unscrew trailing arm on rear axle carrier.

Installation
First insert ball on the inner console.

Important!
Tighten mounting bolts with the car in normal position**
Tightening torque*

M 5
Installation
Tighten bolt with Special Tool 33 3 060 in conjunction with a torque wrench set to 55 Nm (40 ft. lbs.)

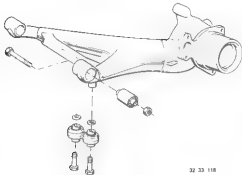
Unscrew stabilizer.
Unscrew shock absorber and take off the trailing arm.
Important! Installation
Tighten mounting bolts with the car in normal position**
Tightening torque*
Check ride level height of car with ride control - see 37 15 010, adjusting it.

* See Specifications
** See Specifications of Gr. 32

33-32/3

33 32 021 REPLACING TRAILING ARM

Remove trailing arm - see 33 32 000.
 Replace wheel bearings and shaft seal - see 33 32 181.
 Transfer guard.
 Rubber mounts are already installed in a new trailing arm.

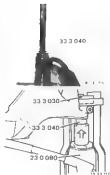


33 32 118

33 32 041 REPLACING BOTH THRUST RUBBER MOUNTS

- Trailing Arm Removed -

Press out rubber mounts in a press with Special Tool 33 3 040



If a suitable press is not available, press out (and in) rubber mounts with Special Tools 33 0 080 and 33 3 030 040.

Screw in part of the pressing tool in such a manner, that the threaded section faces up.



Longer section of each inner bushing faces the center of the car

33 32 041

Eccentric thrust rubber mounts could be installed to correct rear axle toe deviation caused by the unfavorable summary of tolerances.

Important:

This measure may never be applied for the "elimination" of changes in axle geometry caused in an accident.



33 32 001

Mark the trailing arm in horizontal position on the trailing arm eye.

Check the rear wheel alignment - refer to Group 32



33 32 002

Take the corresponding angle displacement from the following diagram.
Connect the numbers for toe correction on both ends of the rubber mount with lines.



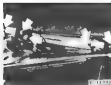
33 32 003

Coat the rubber mount with Greasolite[®] and apply it on the trailing arm, that the line is aligned with the mark on the trailing arm. Press the rubber mount in. Mount the trailing arm and check the rear wheel alignment.

Remove complete trailing arm - refer to 33 32 000

Press the rubber mount out - refer to 33 32 001

If correction on the outer rubber mount is not sufficient, an eccentric rubber mount may also be used on the inside.

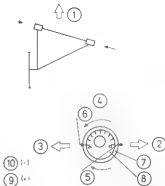
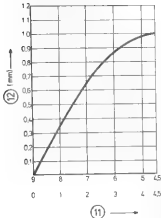


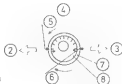
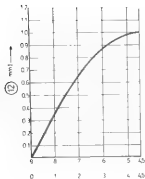
33 32 040



TOE CHANGE ON LEFT REAR WHEEL

- 1 Forward direction
- 2 Forward direction - inner rubber mount
- 3 Forward direction - outer rubber mount
- 4 Pressing-in note
- 5 Reading point - toe increase
- 6 Reading point - toe decrease
- 7 Trailing arm eye
- 8 Thrust rubber mount
- 9 Toe increase
- 10 Toe decrease
- 11 Displacement angle
- 12 Toe change



TOE CHANGE ON RIGHT REAR WHEEL

- 1 Forward direction
- 2 Forward direction - inner rubber mount
- 3 Forward direction - outer rubber mount
- 4 Pressing-in rate
- 5 Reading point - toe increase
- 6 Reading point - toe decrease
- 7 Trailing arm eye
- 8 Thrust rubber mount
- 9 Toe increase
- 10 Toe decrease
- 11 Displacement angle
- 12 Toe change



33 33 006



33 33 006



33 33 006

33 33 071 REPLACING RUBBER MOUNTS FOR REAR AXLE CARRIER

Remove the rear seat.
Support the trailing arms from underneath.
Unfasten the thrust strut.

Important:
Replace the anti-lock nuts,
tightening torque*

Rock the studs out upwards

Important:
Don't damage the threads.
If applicable, cut off protruding rubber at
the openings.

Place Special Tool 33 3 121 on the rubber
mount between the body and rear axle
carrier, and screw in Special Tool 33 3 107.
Apply Special Tool 00 8 550 with its claws
in the openings, secure with Special Tool
33 3 107 and pull the rubber mount out
toward the rear axle carrier at the rubber
mount take-up with an industrial foot air
blower to make this step easier.



Place Special Tool 33 3 123 on the edge of
the take-up plate between the body and
rear axle carrier, and screw in Special Tool
33 3 105.

Coat the rubber mount with Grease[®] and
apply it on the rear axle carrier.
Pull it in using Special Tools 33 3 122 and
33 3 104.

* Refer to Specifications.

** Refer to Specifications.
*** Source of Supply: Stahl Parts.



33-41-151 REPLACING SHAFT SEALS AND WHEEL BEARINGS

Unscrew output shaft on drive flange and suspend from car on a piece of wire.
Remove rear brake disc - see 34-21-320
Installation:
Tightening torque*



Left out rockplate
Remove ABS speed sensor



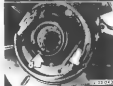
Mount Special Tool 33-4-000 with two
M 10 x 30 bolts
Unscrew collar nut



Put off drive flange with Special Tool
00-7-001 and two M 10 x 30 bolts



Screw on collar nut flush with end of shaft
and drive out with a nylon hammer
Installation:
Check spiders
Check drive flange, replacing flange if necessary



Left out circlip



Put out wheel bearings with Special Tools
33-4-031 33-4-032 and 33-4-038



Use Special Tool 33-4-033

* See Specifications

33-41/2

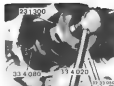
Pull cover bearing shell off of the rear axle shaft with Special Tool 00 7 500



Push in complete wheel bearing with Special Tools 33 4 038, 33 4 032 and 33 4 030

Use Special Tool 33 4 037

Install race 3



Push in rear axle shaft with Special Tools 33 1 300, 33 4 080 and 33 4 030

Important:
Give bearing surfaces on roller nut a light coat of oil
Apply Special Tool 33 4 080
Tighten roller nut
Tightening torque*

Drive in lockplate with Special Tools 33 4 080 and 00 5 000

Install output shaft
Tightening torque*

* See Specifications

33 52 100 Removing and installing complete left or right rear spring strut shock absorber

Level control, refer to 37 12 100

Warning

Remove backrest, refer to 52 20 060.

Touring
Remove wheel arch trim,
refer to 51 42 121.

Jack up vehicle and support semi-trailing arm



51 42 121



51 42 121

Caution*

The spring strut shock absorber performs the function of an arrester band.

Inflation, jacking and remove spring strut shock absorber from semi-trailing arm

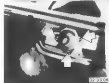
Installation

Tightening torque 33 52 142*

Let up trim (1)



Remove cap (2)



Break spring strut shock absorber, unfasten spring and remove spring strut shock absorber



Installation

Replace spring disc (1)
Replace self-locking nuts
Tightening torque 33 52 142*

Note

Only store shock absorbers in upright position.
If shock absorbers are stored for extended periods with the piston rod retracted, this can give rise to hammering noises when driving.
Remedy:

Remove piston rod and store shock absorber upright at room temperature for 24 hours.

* Refer to Technical Data

33-52 131 Replacing rear left or right spring strut shock absorber

Whether a shock absorber needs to be replaced can only be determined by testing it when installed with a shock tester or when removed with a shock absorber testing machine.

Refer to 31-37 0162 (M2).

When replacing a spring strut shock absorber with the same identification designation must always be installed.

 spring strut shock absorber refer to 33-52 100

Check support bearing (4) for damage.



33-52 014

Remove cap (1).



33-52 015

 Remove support bearing and coil spring.

Installation note

Refer to spring strut layout for installation air

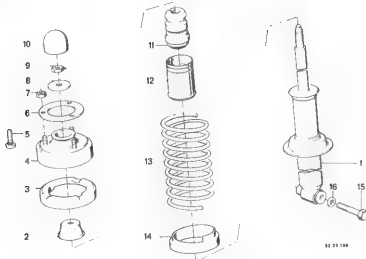
 For tightening torque 33-52 342*



33-52 012

* Refer to Technical Data

REAR SPRING STRUT LAYOUT DRAWING



- 1 Shock absorber
- 2 Support
- 3 Upper spring ring
- 4 Mount
- 5 Bolt
- 6 Insulator
- 7 Collar nut M 8
- 8 Disc

- 9 Nut M 10 x 1 8.2%
- 10 Cap
- 11 Rubber damper
- 12 Protective tube
- 13 Coil spring
- 14 Lower spring ring
- 15 Bolt M 14 x 1.5 x 80
- 16 Washer

12 23 198

**33 53 000 Removing and installing rear
left or right coil spring**

The procedure is identical as that for replacing
spring strut shock absorber: refer to 33 52 031

TROUBLESHOOTING REAR AXLE

Condition	Cause	Correction
Load change knock	Backlash excessive Output shaft defective Play in propeller shaft slide	Adjust backlash — see 33 12 641 Replace output shaft — see 33 31 000 Install slide with Loctite No. 24 for joints
Traction or compression noise	Backlash excessive or insufficient	Adjust backlash — see 33 12 641
Drumming	Propeller shaft Rubber mounts on rear axle carrier defective	See "Troubleshooting Propeller Shaft" Replace rubber mounts — see 33 33 071
Oil leak	Radiator seal leak "vent clogged" Wrong oil grade*	Replace radiator oil seals Clean vent — see Service Information of Group 33 Replace final drive oil
Vibration	Imbalance of wheels Output shaft defective Propeller shaft	Balance wheels replacing tires if necessary Replace output shaft — see 33 31 000 See "Troubleshooting Propeller Shaft"
Rattling or grinding noise	Shock absorbers loose Upper shock absorber rubber mount defective Lower shock absorber rubber mount defective Rubber mounts on rear axle carrier defective	Tighten shock absorbers Replace rubber mount Replace shock absorber — see 33 52 100 Replace rubber mounts — see 33 33 071
Spinning wheels only when driving in curves	Wheel bearings defective	Replace wheel bearings — see 33 41 151

34 Brakes

34 00	General information	34	0/1
34 00	Notes on brake fluid	34	0/1
34 00	Notes on brakes	34	0/1
34 00	Notes on brake lines	34	0/1
	General information ABS/ASC+T	34	0/2
34 00 009	Brake test on test rig	34	0/2
519	Foot brakes (high pressure - low pressure check) - check	34	0/3
017	Brake booster - check function	34	0/4
046	Brake system - bleed	34	0/5
047	Brake system with ABS - bleed	34	0/5
	Function description ASC+T	34	0/6
	Function test brake isolation without test equipment	34	0/6
048	Brake system with ABS/ASC+T - bleed	34	0/7
040	ASC+T mineral oil circuit - bleed	34	0/9
048	Brake system with ABS/ASC+T - bleed	34	0/10
34 10 014	Handbrake - adjust	34	10/1
34 11 000	Pads of both front disk brakes - remove and install/replace	34	11/1
020	Front brake calipers - remove and install	34	11/2
092	Front brake calipers - overhaul	34	11/3
220	Front brake disc - remove and install	34	11/4
599	Front brake disk - check for runout and thickness deviation	34	11/5
667	Front brake disc - grind	34	11/5
34 21 200	Rear brake pads - remove and install	34	21/1
745	Rear brake calipers - remove and install	34	21/1
292	Rear brake calipers - overhaul	34	21/2
320	Rear brake disks - remove and install	34	21/3
879	Rear brake disks - check for runout and thickness deviation	34	21/4
947	Precision turning rear brake disks	34	21/4
34 31 000	Master brake cylinder - remove and install	34	31/1
500	Master brake cylinder - remove and install (M60)	34	31/2
34 32 361	All brake lines - replace	34	32/1
381	Brake hose, front - replace	34	32/1
451	Brake hose, rear - replace	34	32/1
34 33 505	Brake unit (brake booster) - remove and install or replace	34	33/1
505	Brake unit (brake booster) - remove and install or replace	34	33/2
051	Non-return valve for brake unit - replace	34	33/3
071	Vacuum hose for brake units - replace	34	33/3
34 41 000	Hand brake lever - remove and install	34	41/1
	Arrangement: handbrake lever	34	41/2
100	Handbrake Bowden cable - remove and install	34	41/3
220	Handbrake shoes - remove and install	34	41/3
	Arrangement: ABS	34	50/1
	Function and examination of the ABS telltale	34	50/2
34 50 000	Anti-lock braking system - function check	34	50/3
34 51 520	Hydraulic unit (for ABS), complete unit - remove and install or replace	34	51/1
520	Hydraulic unit (for ABS), complete unit - remove and install or replace (M60)	34	51/2
	ABS components	34	51/4
525	Hydraulic unit (ASC+T) - remove and install or replace (M60)	34	51/5
525	Hydraulic unit (ASC+T) - remove and install or replace	34	51/7
34 51 540	ASC+T filter - remove and install or replace	34	51/8
34 52 510	Control unit (for ABS) - replace	34	52/1
61 12 510	One impulse sensor (for ABS) at front - replace	34	52/2
522	One impulse sensor (for ABS) at rear - replace	34	52/2
61 31 570	Relay on hydraulic unit (for ABS) - replace	34	52/3
62 99 080	Telltale for ABS - replace	34	52/3
	Brake system - troubleshoot	34	90/1

34 00 General information

Ensure absolute cleanliness and only use hot-free cleaning rags

No oil or grease must enter the brake system as this could cause the brake system to fail.

On no account must brake oil enter the brake system when cleaning brake components with brake cleaner (refer to [Brake Parts Service](#)).

Even small traces of brake oil must be avoided. Only use approved assembly paste when carrying out repairs on brake calipers (refer to [Brake Parts Service](#)).

Wash off brake dust or remove with vacuum cleaner. Do not blow off with compressed air. This could be hazardous to health.

34 00 Notes on brake fluid

Refer to [BMW Fluids and Lubricants Specifications](#)

Should brake fluid get into the eyes immediately flush with ample clean water and treat accordingly (p. 6).

Avoid skin contact. If necessary, clean with soap and water.

Replace brake fluid every two years at the latest.

On no account reuse drained brake fluid.

Dispose of the brake fluid only at approved facilities (refer to [Workshop Equipment Planning documentation](#)).

Ensure the brake fluid comes in contact with the vehicle's paintwork as soon as it is applied and destroy paint.

34 00 Notes on brake pads

Brake disks, brake drums, brake pads

Brake disks, brake drums and brake pads should only be replaced in a set.

Brake disks, brake drums must show no signs of scoring or cracks.

Minimum disk thickness (BMW TSI) with full and parallel alignment and post-install height of friction surfaces must not exceed or drop below the permissible limits (refer to [Technical Data](#)).

Brake pads must not wear down to below the specified minimum pad thickness (refer to [Technical Data](#)).

Remove (preparing) aged or new components before installing

34 00 Notes on brake lines

Release and tighten brake and air line fittings only with a special brake line wrench (PWA avoid damaging brake lines)

Close off open connections of brake lines and individual components to ensure no dirt can enter the brake system.

The brake system must be bled after brake lines have been released.

Check all connecting parts for leaks.

Brake lines and brake hoses must be laid correctly and must not rest or chafe on the body or body components.

Only tighten brake hoses at the front wheels only with the wheels in the straight ahead position.

General Instructions for ABS/ASC+T

The ABS requires no maintenance at all but you must observe the following when ABS is fitted:

Plug must be pulled off the electronic control unit when working with an electric welder (welding switched off)

During painting work, the electronic control unit can be exposed for up to 2 hours to max. 55° C and, over longer periods, to max. 35° C

Do not incorrectly connect up the brake lines on the hydraulic unit, if necessary work them prior to disassembly

The ABS system must be checked in accordance with the Electrical Troubleshooting Manual if one of the following ABS components is removed or replaced:

- Hydraulic unit
- ABS control unit
- Wheel speed sensor
- ABS wiring harness
- Valve control relay
- Electric motor relay

570 with ASC+T up to model year 04.

The ABS/ASC control unit must be reprogrammed in accordance with the BMW Diagnostic unit if one of the following components is removed or replaced:

- ABS control unit
- Throttle valve assembly
- Throttle valve potentiometer

34 00 000 Checking Brakes on Test Stand

Requirements:

- Switch off ASC+T
- On four-wheel drive vehicles, switch off GSA system (Governed Locking #W0)
- Use profile 0.8
- Use oil pressure 0.8
- State of operating temperature and dry (if necessary, heat up by applying brakes several times)

Observe the operating specifications of the relevant test bench manufacturer

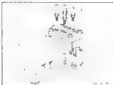


Disable GSA system

In a separate fuse box, in the front left side of the engine compartment, there are two fuses for the GSA system.

To disable the system without activating the error memory, only remove fuse (2).

Fuse	
1	30 A
2	5 A



34 00 518 Check footbrake (high pressure, low pressure check)

Brake output distribution
Without ABS with 4 channel ABS

1st brake circuit, front right and rear left
2nd brake circuit, front left and rear right



Brake force distribution
With 3 channel ABS, ASC, F
1st brake circuit, front axle
2nd brake circuit, rear axle



Brake force distribution
ABS, ABS, ASC, F from model year 04
1st brake circuit, front axle
2nd brake circuit, rear axle



Unscrew the bleeder valve on a wheel brake
in the 1st brake circuit
Connect up pressure tester and bleed the system.



High Pressure Leak Test

Apply force* to brake pedal and block brake pedal with pedal support.
Pressure may drop by max. 8 % after two minutes.



Low Pressure Leak Test

Release pedal support, until test pressure in brake system falls to between 2 - 3 bar.
Vehicle and display unit must be at rest because vibrations falsify the results.
Over a test period of 5 minutes, the pressure must not drop at all.
If pressure drops sharply, check all rubber parts.
After the leak check, bleed the brake system, refer to 34 00 048-047

Follow similar procedure for high and low pressure leak test of the 2nd brake circuit.

34-00 017 CHECKING FUNCTION OF BRAKE BOOSTER

1. Operation Test

Operate the brake pedal with the engine stopped so often until it is hard to operate. Operate the brake pedal and start the engine.

The brake booster is okay if the brake pedal gives.

If not, refer to the troubleshooting chart.

2. Leak Test

Run engine at about 3,500 rpm to operating temperature and release the accelerator (repeating 3 or 5 times) to build up vacuum in the brake booster.

Stop the engine and operate the brake pedal with a force which is equal to normal braking of the car.

The brake pedal operation should be spongy at least 1 or 2 times, whereby the suction holes of the brake booster will be filled.

In this case there is no leak and the system is okay.

If not, refer to the troubleshooting chart.



3. Engine Vacuum Test

Disconnect the vacuum hose from the vacuum.

Install Special Tool 34-3 180 between the brake booster and non-return valve.

Run engine at about 3,500 rpm to operating temperature and release the accelerator (repeating 2 or 3 times) to build up vacuum in the brake booster.

Specification: approx. - 0.7 bar

Stop the engine and discharge the vacuum by operating the brake pedal several times. Repeat this test two times.

If not okay, refer to Group 51.



4. Brake Booster Test

Unscrew the bleeder screw from the left front brake caliper.

Connect the pressure tester and bleed. Mount a pedal force meter on the brake pedal.

Run engine at about 3,500 rpm to operating temperature and release the accelerator (repeating 2 or 3 times) to build up vacuum in the brake booster.

Apply force* to the brake pedal.

This must cause the line pressure of the brakes to reach the "nominal value".

If this value is not reached in a brake system in perfect condition, replace the booster.



* Refer to Specifications.

BLEEDING BRAKES**Notes**

Only use approved brake fluid¹⁾
 Conform with the brake fluid change intervals

Keep brake fluid off of painted surfaces on the car as brake fluid would destroy the paint finish



Fig. 34-0/5

Connect a bleeder to the brake fluid tank**Notes**

Conform with the operating instructions supplied with a pertinent bleeder
 The charging pressure must not exceed 1 bar



Fig. 34-0/5

Connect the bleeder hose with bottle to the bleeder screw of the right rear brake caliper

Loosen the bleeder screw
 Tighten the bleeder screw when bubbleless brake fluid runs out
 Repeat these bleeding procedures at left rear, right front and left front



Fig. 34-0/5

After Finishing Work

Check the brake fluid level
 Check rubber gasket (1)

¹⁾ Refer to Operating Fluids

34-00-007 BLEEDING BRAKES WITH ABS

Connect a bleeder to the brake fluid tank.
 Conform with the operating instructions supplied with a pertinent bleeder

Important

Don't use air flushing

Operate and hold the brake pedal down

Connect the bleeder hose with bottle to the bleeder screw and open the bleeder valve on the wheel brake, beginning at right rear
 Release the brake pedal and then operate it as far as the stop twice times

Push the brake pedal in down position
 Shut the bleeder valve

Release the brake pedal
 Repeat these procedures at left rear, right front and left front

DESCRIPTION OF AUTOMATIC STABILITY AND TRACTION CONTROL (ASC-T)

Tasks of ASC-T

- Taking the load off the driver during car operation
- Guarantee of directional stability and steering
- Improvement of traction (T)
- Information for the driver

Description of Operation

The system has the task of regulating the slip of the driven wheels to an optimal value in reference to directional stability and vehicle propulsion regardless of the driving situation.

For regulation the engine torque is reduced by influencing the ignition system (timing control) or injection/ignition (cutoff via DME) and reducing the throttle valve gap (ADB, ASC throttle valve positioner). If these measures are not sufficient, the driven wheel rotating too fast is slowed down by the wheel brake.

The system is switched on automatically after starting the engine and can be switched off manually. The ASC lamp is off when the system is switched on.

When regulation is activated, 17% is reported to the driver by a flashing ASC lamp in the instrument cluster.

If the ASC lamp lights up continuously, the system has been switched off automatically due to an occurred fault or had been switched off by hand.

Note

Throttlecableing: refer to Car Electric / Electronic Test Plan.

Important

The master air circuit must be bled if repairs had been carried out on mineral oil equipment and pipes between the tank and up to and including the ASC-T hydraulic control unit.

Switch the ASC-T off for tests on the brake dynamometer or performance test stand?

OPENED BRAKE SYSTEM FUNCTION TEST WITHOUT TESTER

Car on lifting platform — wheels have cleared ground.

Prerequisites

- Left rear wheel can be turned easily

- Move shift lever into neutral or selector lever into "N"

- Start the engine

Regulate the engine speed to 2000 ± 150 rpm with help of the accelerator pedal.

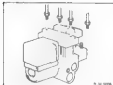
- Spin the left rear wheel quickly by hand in forward direction (if applicable, hold the right rear wheel tight during test)

Position

- Left rear wheel is braked vigorously

Precautions

- Repeat the test on the right rear wheel.



34 00 048 Yarding brake system with ABS-ASC+T (ABS-ASC+T 12V M50 up to model year 94)

Note

Conform with the filling and bleeding procedures when replacing or repairing the tandem master brake cylinder, hydraulic unit, ABS-ASC+T and components installed between them.

For other work on the brake system (e.g. replacing the brake calipers), conform to special caution: "Bleeding brake system with ABS" refer to 34 00 047.



1. Bleed suction line

Fit head of bleeder bottle to the bleed screw on the hydraulic unit.
Open bleeder screw and flush suction line until brake fluid emerges without air bubbles.
Close bleeder screw.

Note

For greater ease of access to bleeder screw, special tool 34 3 110 can be used.

Caution!

Always ensure that there is no hydraulic fluid in special tool 34 3 110. If necessary, clean before use.

Information

Tightening torque 34 00 142*

Connect BMW Service Tester - MeSD to diagnose plug.
Call up diagnosis program (ABS-ASC-ASD).



2. Perform preliminary bleeding operation on brake system.

On each wheel brake, open vent screw in specified sequence and flush until brake fluid emerges without air bubbles.

Sequence

rear right
rear left
front right
front left



Connect bleeding device to expansion tank and switch on.

Note

Conform with manufacturer's operating instructions.

Charging pressure should not exceed 2 bar.



3. Bleed secondary circuit in hydraulic unit

On rear right wheel brake, connect bleeding bottle.
Loosen bleeder screw.
Perform bleeding operation using BMW Diagnostic System.
Close bleeding screw.

* Refer to Technical Data

4 Bleed brake system (draining operation)

On each wheel brake, in the specified sequence, drain off approx. 50 cm³ of brake fluid.

Sequence:

rear right
rear left
front right
front left

Then perform following procedure on each wheel brake:

- Open bleeder screw
- Depress brake pedal hard 3 times
- Drain excess brake fluid until it emerges without air bubbles for about 100 cm³

Sequence:

rear right
rear left
front right
front left



Switch off bleeding unit and remove from expansion tank.

Check brake fluid level.

Pay attention to rubber seal (1).

Remove BMW Service Tester - MoDiC and connect to B diagnostic plug.

34-00-046 BLEEDING ASC + T MINERAL OIL CIRCUIT

1 Filling Mineral Oil Circuit

Important:
Ensure that brake system is filled with brake fluid before filling the mineral oil circuit with hydraulic fluid.

Fill brake system - refer to point 1 in 34-00-048



Switch off engine
Unscrew screws and take lid off of elec-
tronic box



Unlock and pull plug (1) off of ASC+T
control unit

**Fill circuit with hydraulic fluid - refer to
Group 32**



2 Bleeding Mineral Oil Circuit

Apply
The plunger-type hydraulic control unit is
bled by running the engine

Switch off engine
Connect plug (1) on ASC+T control
unit

**Start and run engine at idling speed at least
60 seconds (automatic charging of ASC+T
plunger-type reservoir)**



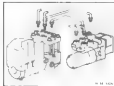
**Apply Special Tool 34-3-110 on bleeder
screw of plunger-type hydraulic control
unit and place end of hose in supply tank.**
Loosen bleeder screw and flush plunger-
type hydraulic control unit until bubbles
hydraulic fluid runs out (at least 10 sec.).
Tighten bleeder screw

Apply
tightening torque*

**Check and, if necessary, correct hydraulic
fluid level - refer to Group 33.**

* Refer to Operating Fluids

* Refer to Specifications



34-00 048 Bleed brake system with ABS-ASC-T

ABS-ASC-T with plunger hydraulic unit

Note

Use the specified filling and bleeding specification when repairing or replacing components in the tandem master brake cylinder and ASC-T (plunger hydraulic unit) (both included in each call).

For all other work on the brake system (e.g. replacing the brake calipers), continue to use the relevant specification "Bleeding brake system with ABS" (refer to 34-00 047). This can also be used on vehicles fitted with a SC-T.



1 Fill brake system with brake fluid*

Connect bleeder hose and fluid receptacle to rear right brake caliper.
Open bleeder valve and bleed until brake fluid emerges without air bubbles, for at least 4 minutes. Then close the bleeder valve.
Fill wheel brakes at rear left, front right and front left in a similar manner (bleed time per front wheel brake at least 1 minute).

2 Bleed brake system

Caution!

Before performing the bleeding operation, always ensure that the oil side of the ASC-T plunger hydraulic unit has been vented. This applies especially when replacing or repairing relevant oil assemblies and lines between the expansion tank and the plunger hydraulic unit. If necessary, before bleeding the brake system, first bleed the ASC-T mineral oil circuit, refer to 34-00 045.

It is only possible to vent the ASC-T hydraulic unit correctly in conjunction with ABS-ASC test equipment 34-5 112.



Connect bleeder unit to expansion tank

Note

Conform with operating instructions supplied with bleeder.
The fill pressure must not exceed 2.5 bar.

* see BMW Operating Fields Specification

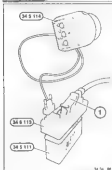


2.1 Bleed rear axle brake circuit

Switch off ignition
Unscrew screws and remove cover from the electronic ABS.



Unplug control unit plug (1) and remove from control unit of ABS/ESC.



Attach test adapter 34.5.113 to test control unit 34.5.111.

Attach diagnosis connection cable 34.5.114 to test adapter 34.5.113.

Attach control unit plug (1) to test adapter 34.5.113.



Move shift lever (manual) into neutral or move selector lever (automatic) into "P" or "N".

Start engine.



Connect the bleeder hose with bottle to the right rear brake caliper.
Open bleed valve and fully depress brake pedal at least 30 times (brake fluid must emerge without air bubbles).

Release brake pedal.



Activate red button to start bleeding routine (duration approx. 60 seconds).

Caution!
Brake fluid should emerge without bubbles. If necessary, repeat the bleeding procedure.

Close the bleeder valve.

Bleed rear left wheel brake in similar manner.

Switch off engine.



2.2 Bleed front axle brake circuit

Connect bleeder hose and bottle to front right brake caliper

Open bleed valve and fully depress brake pedal at least 12 times (brake fluid must emerge without air bubbles).

Keep the brake pedal depressed, close the bleeder valve and release the brake pedal

Bleed the front left wheel brake in a similar manner



Switch off bleeder unit and remove from as reservoir tank

Check brake fluid level

Screw cap on the brake fluid tank (ensure that rubber seal (1) is installed in cap)

Switch off ignition

Disconnect control unit plug from adapter and connect up to ABS-ABC-T control unit.
Install cover on electronic box.



34 00 048

34 00 048 Bleeding brake system with ABS/ASC-T

ABS/ASC-T from model year '04

Notes

Conform with the filling and bleeding procedures when replacing or repairing the

Tandem master brake cylinder
hydraulic unit, ABS/ASC-T
and components installed between these
two assemblies.

For other work on the brake system (e.g. re-
placement of brake calipers), conform to spec
bulletin "Bleeding the ABS brake system"
refer to 34 00 047

Caution

Refer to "General Data"

Connect up BMW Service Tester MoDiC to
diagnose plug.
Call up diagnostic program (ABS/ASC/ABS).



34 00 047

Connect bleeder unit to expansion tank and
switch on.

Note

Conform with operating instructions supplied
with bleeder unit.
Charging pressure should not exceed 2 bar



34 00 049

Fit bleeder hose and bottle to bleeder valve on
rear right brake caliper

Open bleeder valve and bleed until clear
bubble-free brake fluid emerges.
Close the bleeder valve.

Follow similar procedure on rear left, front
right and front left wheel brake



34 00 048

Bleeding rear axis brake circuit

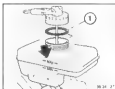
Attach bleeder hose and bottle to vent valve
on rear right brake caliper

Open up vent valve.
Perform bleeding routine with BMW diagnosis
system.
Close the bleeder valve.
Follow similar procedure on rear left wheel
brake



Bleed front axle brake circuit.

Fit bleeder hose and bottle to bleeder valve on front right brake caliper.
 Open up bleeder valve.
 Fully depress brake pedal at least 12 times.
 Brake fluid must emerge clear and without air bubbles.
 Hold down brake pedal in fully depressed position.
 Close the bleeder valve.
 Release brake pedal.
 Follow similar procedure on front left wheel brake.



Switch off bleeder unit and remove from expansion tank.
 Check brake fluid level.
 Seal expansion tank (note rubber gasket (1) in cover).

Remove BPH Service Tester, MoDc and close diagnosis plug.

34 10 014 ADJUSTED PARKING BRAKE

Test Specifications

- There should not be braking effect when parking brake lever is pulled up one tooth
- The wheel peripheral force may deviate from the target value by max. 35 % in each position with the opposite wheel (tested on dynamometer)
- Adjustment is necessary in case of greater brake force difference
- It should be possible to hold the car with the parking brake.
- The parking brake must be adjusted if the parking brake lever travel is greater than ten teeth

Note

The parking brake can only be adjusted correctly if the parking brake cables and all moving parts of the parking brake move easily and function correctly

Basic parking brake adjustment is necessary

- After replacing brake shoes
- After replacing brake drums
- After replacing slack control device
- In case of excessive parking brake lever travel (see test 6)

1 Basic Adjustment

1.1 Drum Brake

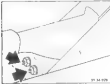
Note

If applicable, mount the wheels (brake drums must be blocked).
Tightening torque*

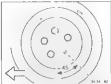
Operate the brake pedal so long until the slack control sound (soft click) is no longer heard.
(The slack control operation can also be observed through a wheel bolt bore.)



1.1.1 Dust cover off



Unscrew the adjusting nuts and loosen the cable completely



(Duo-Servo Parking Brake)

Unscrew and remove one wheel bolt from bottom of wheel

Turn wheel until the tapered bore is positioned against 68 (behind a vertical line at top (as seen in forward driving direction).

Installation

Install and tighten wheel bolt
Tightening torque*



Turn adjusting screw using a screwdriver until the wheel or brake disc can no longer be turned.
Loosen the adjusting screw if catches afterwards.

* Refer to Specifications

2 Adjusting Cables

2.1 By Hand

Put parking brake lever up four teeth and turn the adjusting nuts until it is just possible to still turn the rear wheels.

Release the parking brake lever. It must be possible to turn (all wheels) easily.

Switch (spring on) the control lamp must not be on with a released parking brake lever.

- | | |
|---------|--|
| 1 tooth | No braking effect.
Control lamp could be on. |
| 2 teeth | Control lamp must be on. If necessary adjust the switch contact on the parking brake lever. (refer to Group 8) |

2.2 On Dynamometer

Caution!
Stop operation of the ECU lock in four wheel drive cars. (refer to 34-00 000)

- | | |
|---------|--|
| 5 teeth | Parking brake lever released: wheel peripheral force at lifting speed in cars
a) without limited slip differential > 150 N
b) with limited slip differential > 200 N |
| 1 tooth | No braking effect.
Control lamp could be on. |
| 3 teeth | Control lamp must be on. If necessary adjust the switch contact on the parking brake lever. (refer to Group 8) |

Checking of braking force difference with:
dual-servo parking brake in 1st tooth
drum brakes in 2nd tooth

The full-range brake force display must be 600 ± 50 N.

3 Breaking in Specifications for Dual-Servo Parking Brake

The following breaking in procedures are applicable in case of insufficient braking effect or after replacing brake discs and/or brake shoes.

With car moving approx. 40 km/h pull up the parking brake lever until braking of the car is noticed.
Then pull up the parking brake lever into the next catch and drive approx. 400 meters in this position.
(A basic requirement is that the parking brake is adjusted uniformly.)

Note
The parking brake is completely independent of the service brake and consequently is only subjected to limited wear.
Oils when dirt and corrosion will cause the braking effect of the parking brake to give in the course of time.

34 11 000 Removing and installing or replacing brake pads of both

Prerequisites

After finishing work, test brake pedal spring force to ensure the brake pads rest on the .

Remove front wheels, refer to 34 10 000.

Remove caps (1)

Loosen (1) cable connector from brake .

Release guide screws (2)

Installation note

Only clean guide screws, do not grease. Check thread! Replace guide screws if not satisfactory. For tightening torque 34 11 3A 2*.

Loosen retaining spring (3) and push brake caliper forward and remove.



Remove brake pads from brake caliper. Check dust cover for wear and replace if .

Installation note

Check pad thickness*.

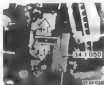
Caution*

New brake pads* should only be installed if the brake disk thickness is greater than or equal to the minimum thickness* (MM 10).

Lightly coat brake pad back plates at the contact points with anti-squeal paste. For anti-squeal paste, refer to BMW Fluids and Lubricants Specifications.



34 11 030



Installation note

Completely push back piston with special tool 34 10 000.

Clean brake pad guides on brake caliper and brake back plate with a brush** and thinly coat with anti-squeal paste. For anti-squeal paste, refer to BMW Fluids and Lubricants Specifications.



* Refer to Technical Data

* Refer to Technical Data

** Source of supply: BMW Parts Service

34-11/205 REMOVING AND INSTALLING FRONT BRAKE CALIPER

Remove front wheel — see 34-10/200
Draw off brake fluid with a syringe, which
 is reserved exclusively for brake fluid.
Disconnect brake pipe

Unscrew brake caliper bolt (1)
(distortion)
Tightening torque*

Disconnect brake pad wear indicator plug
Put off brake caliper forward
resistance — important!
Check that brake pad wear indicator went
a hand in correct position by tab of dust cap
Bubbling of the pure on the wheel rim must
always be avoided.



34-11-1

34-11-000 OVERHAULING FRONT CALIPER

— Use Repair Kit —

Remove front caliper — see 34-11-000

Press off plastic caps (1)

Unscrew guide bolts (2)

Installation

Only clean guide bolts — don't lubricate them

Check guide bolts, replacing if necessary
Tightening torque*

Disassemble caliper and take out brake pads
Installation

Press out brake pads completely before
installing spring (4)



34-11-2



34-11-3

Press off rubber cap and clamping ring

Place a liner (piece of hard wood, hard felt
or something similar) in caliper recess to
protect the piston

Press out piston with compressed air
applied through the connection bore
Caution!

Air pressure of 10 bar (145 psi) produces
a force of about 1250 N (275 lbs.)

Check guide sleeves (5), installing guide
sleeves from the repair kit if necessary



34-11-4

* See Specifications



34-11-5

Remove seal carefully with a plastic needle
Clean cylinder bore and parts with alcohol
and dry with compressed air
Check cylinder bore, piston and flange
surfaces thoroughly for damage
Machining of cylinders and piston is not
approved

Installation

Give all parts a light coat of ATE brake
cylinder paste and install



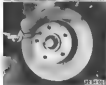
34-11-6

First pull rubber cap on to the piston
Press in piston with a piece of hard wood,
being careful not to cant the piston



34-11-7

Pull rubber cap over edge of cylinder bore
and secure with the clamping ring
Assemble the caliper



34 11 300 REMOVING AND INSTALLING FRONT BRAKE DISC

Remove front wheel see 34 10 300
Pull rubber grommet (1) out of bracket

Unhook caliper and suspend from car on a piece of wire
important!
The brake pipe remains connected
caution
Tightening torque*

Unhook bolt and take off the brake disc
caution
Tightening torque*
important!
Always replace both brake discs of one
axis together



34-11-566 CHECKING FRONT BRAKE DISC FOR RUNOUT AND DEVIATION IN THICKNESS From Wheel Removed

Requirements: wheel bearings okay
Procedures: on Remounted Brake Caliper
 Mount Special Tools DD 2-600 and SD 1-423 on brake caliper.
 Secure brake disc with two M 12 x 1.5 bolts additionally.
 Check lateral "runout" of brake disc with a dial indicator.

If the brake caliper is disassembled (for replacement of brake pads): Special Tools DD 2-600 and SD 2-490 can be mounted directly on the caliper support bolts (for guide bolts).

Measure deviation in thickness* of braking surface at about 8 points with a micrometer.

* See Runout/Runins



34-11-567 FINISH GRINDING FRONT BRAKE DISC Brake Disc Removed

Important!
 Always grind both sides of both brake discs on one side.
 Check in "Runin (thickness)".
 After machining to final size* one more brake pad set may be installed and used until more "see wear limit").
Attention:
 If it is necessary to replace a brake disc, always replace both brake discs of one axle.



34 21 200 REMOVING AND INSTALLING REAR BRAKE PAD

Remove rear wheel.
Press off plastic cap (1).
Note:
Pull off plug for brake pad wear indicator.



Unscrew guide bolts (2).
Installation:
Only when guide bolts show 1 full thread
Install.
Replace guide bolts not in perfect
condition.
Tightening torque*



Press out clamp (3).
Pull off caliper toward rear.



Take off outer brake pad.
Inner brake pad is located in the piston
together with a spring.
Inspection!
Always replace all brake pads of both brake
calipers on one axle.
Installation:
Lubricate backs of brake pads lightly with
Plastolube** at the brake piston contact
points.

* See Specifications.
** Source of Supply: HWS



Installation:
Push back piston completely.
Clean brake pad guides and recesses with a
brush**.
Caution!
Extract dust cap - handle carefully by following.
Check dust cap for damage.
Lubricate guides lightly with Plastolube**.



34 21 205 REMOVING AND INSTALLING REAR CALIPER

Remove rear wheel.
Drain off brake fluid with a syringe (screwed
exclusively for use with brake fluid).
Disconnect brake pipe.



Unscrew bolts (8).
Unscrew the brake pad wear indicator.
Pull off caliper toward the rear.
Installation:
Tightening torque*
Bleed brakes - see 34 00 347

* See Specifications.
** Source of Supply: HWS

34-21 282 OVERHAULING REAR CAL. PER Use Figure 15-1

Remove rear caliper use 34-21 220

Press off plastic caps 1b

Unscrew guide bolts 2b

retainer pin

Only clean guide bolts steps 1 lubricate them

Check guide bolts replacing if necessary

Tightening 1st pass*

Crossslide caliper and roller dual brake pads inspection

Press out brake pads completely before separating spring 4b

Press off rubber cap and clamping ring

Place hard piece of hard wood hard felt or something similar in the caliper holes to protect the piston

Press out piston with clamp used as applied the length the contact can be seen

note: note

Air pressure of 10 bar (145 psi) produces a force of about 1250 N (275 lbs)

Check guide sleeves 15c installing guide sleeves from the roller hole if necessary

Remove seal carburetor with a plastic needle
Clean cylinder bore and parts with alcohol and dry with compressed air
Inspect cylinder bore, piston and flange surfaces thoroughly for damage
Machining of cylinders and pistons is not approved

Installation

Give all parts a light coat of ATE brake cylinder grease and install

Piston pull rubber cap on to the piston
Press on piston with a piece of hard wood, being careful not to dent the piston

Push rubber cap over edge of cylinder bore and secure with a clamping ring
Assemble the caliper



34 21 320 REMOVING AND INSTALLING REAR BRAKE DISC

Remove rear wheel
Unscrew bolts (1)



Pull off spacer toward rear and suspend
Brake can now be pulled off wheel
Brake pipe remains connected
Unscrew bolt (1) and take off brake disc

Important*

When replacement is necessary, always
replace both brake discs of one axle.
Adjust parking brake - see 34 10 014.
Braking on Parking Brake After Replacing
Brake Discs

Car must be broken in in three phases

Phase 1 5 s full stop braking from
50 km/h (30 mph)

Phase 2 Brakes allowed to cool off

Phase 3 5 s full stop braking from
50 km/h (30 mph)



34 21 479 CHECKING REAR BRAKE DISC FOR RUNOUT AND DEVIATION IN THICKNESS
Rear Wheel Removed

Preparation: On Removed Brake Caliper Mount Special Tools 00 2 500 and 33 1 423 direct on caliper tapped bore after removing the screws for the caliper mounting bolt.

Secure brake disc additionally with two M12 x 1.5 bolts.

Check brake runout* of brake disc with a dial gauge.



If the brake caliper is disassembled (for replacement of brake pads) mount Special Tools 00 2 500 and 00 2 490 direct in a brake caliper tapped bore (for pads bolt).



Measure deviation in thickness* of braking surface at about 8 points with a micrometer.

* See Specifications



34 21 447 FINISH GRINDING REAR

Brake Disc Removed

Important:

Always finish grind both sides of both brake discs on both axles.
Check minimum thickness*

For replacement

If a brake disc has to be replaced, always replace both brake discs of one axle.

* See Specifications

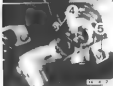


34-31 000 REMOVING AND RETAILING BRAKE MASTER CYLINDER

Draw off brake fluid in tank with a syringe which is reserved exclusively for brake fluid.
Put off plug.
If applicable, pull off hose 1 to fan clutch.



Put off brake fluid tank.
D) connect brake pipes 2 and 31
(Brake Pipe 2)
front right rear left = brake pipe 1
front left rear right = brake pipe 2



Remove mounting bolts 4 and 5
or equivalent

Check rubber seal and connections.
Replace self locking nuts.

continued

Check rubber ring (7).

The building up of vacuum will be prevented
when the sealing is not perfect.



Tandem Brake Master Cylinder Description
Operating the brake pedal moves pistons
11 and 41 forward.
Primary stage 12 and 51 pass over the compensating levers.
There is now balanced pressure in chambers
A and B.

Diagonal Dual Circuit System

Chamber A acts on front right and rear left.
Chamber B acts on front left and rear right.
Brake pedal travel will be considerably longer
when a brake circuit fails.
If the second brake circuit fails, piston 11
will not the pressure building up in chamber B
to push piston 41 in pressurized chamber A
against tandem master cylinder housing and
the first brake circuit functions.
If the first brake circuit fails, piston 11 in
pressurized chamber A will be pushed against
spring-loaded cap (7) and the second brake
circuit will have full action via chamber B.



34-31-500 Removing and installing master brake cylinder (ABS)

Note

When work is completed, bleed the brake system, refer to 34-00-047 for ABS and 34-00-048 for ABS-ESC.

Remove left headlight, refer to Dr 62.



Draw brake fluid out of tank, into a suction bottle reserved for exclusive use with brake fluid.

Left supply line (1) and (2) off master brake cylinder.



Unfasten brake line (3) and (4).

Note

Seal master brake cylinder and brake lines with a suitable moly.

Brake line (3) leads to ABS hydraulic unit, 1st brake circuit (front right rear left)
Brake line (4) leads to ABS hydraulic unit, 2nd brake circuit (front left rear right).

From model year 94.

Brake line (3) leads to ABS hydraulic unit, rear circuit R (rear axle)

Brake line (4) leads to ABS hydraulic unit, connection F (front axle)

Installation

Tightening torque



Unfasten screws and remove master brake cylinder.



Installation

Check rubber ring between master brake cylinder and brake unit, replacing if necessary.
Replace self-locking nuts.
Tightening torque*

* Refer to Technical Data

* Refer to Technical Data

34 32 361 REPLACING ALL BRAKE PIPES

Brake pipes are factory-supplied in straight lengths and correct length with connecting nipples.

Use the removed pipe as a template for bending.

Use bending tool¹.

Don't damage surface of pipe.

Don't bend pipe sharply or attempt to bend back an already bent pipe.

Also refer to Service Information of G-34.



34 32 361 REPLACING FRONT BRAKE

Draw off brake fluid.
Disconnect brake hose
Precautions

Move front brake hose while installing.

Bleed brakes: see 34 00 048.

Tightening torque¹

See Group 34 of Operating Fluid Specifications for approved brake fluids.



34 32 461 REPLACING REAR BRAKE

Draw off brake fluid

Precautions

Move rear brake hose while installing.

Bleed brakes: see 34 00 048.

Tightening torque¹

See Group 34 of Operating Fluid Specifications for approved brake fluids.

¹Source of Supply: MWS

¹ See Specifications

34 33 505 REPAIRING AND INSTALLING OR REPLACING BRAKE BOOSTER

Surf the brake's full out of the brake fluid tank using a syringe used exclusively with brake fluid.



Unscrew brake booster at pedal contact.
Remove brake booster together with brake master cylinder forwards.

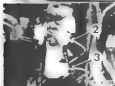
Installation
Tightening torque*
Adjust brake pedal - refer to Group 35.
Adjust brake light switch - refer to Gr. 37

Disconnect the plug
Pull off tank
Disconnect clutch hydraulic hose (1)



Unscrew brake pipes (2 and 3)

Important:
Don't mix up brake pipes
Tightening torque*



Remove dashwood trim panel at bottom left - refer to 31 45 180.
Press off clip (3) and pull out pin (4).

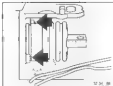


* Refer to Specifications

Refer to Specifications

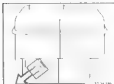
**34 33 300 REMOVING AND INSTALLING
OR REPLACING BRAKE
BOOSTER (BRB)**

Remove brake master cylinder refer to
34 33 500.



Unscrew nuts and remove brake booster
assembly.

Installation
Replace self-locking nuts.
Tightening torque*



Let out retainer and remove brake fluid
care.



Disconnect vacuum hose at brake booster



Let out retainer and pull out retaining pin.

Important*
Ensure the retainer engages correctly when
installing.



34-33 081 REPLACING NON-RETURN VALVE FOR BRAKE BOOSTER

Disconnect the vacuum hose at non-return valve (1).

Insulation
Replace the clamps.



Loosen the clamps and remove the non-return valve (2).

Installation
The arrow on the non-return valve must point in direction of the intake manifold.
Replace the clamps.



34-33 071 REPLACING VACUUM HOSE FOR BRAKE BOOSTER

Unscrew the vacuum hose at the brake booster (1).

Insulation
Replace the clamps.



Unscrew the vacuum hose at non-return valve (1).

Installation
Replace the clamps.





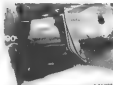
34-41-000 REMOVING AND INSTALLING PARKING BRAKE LEVER

Lift out air extraction mask.
 Unscrew nuts (1) and (2).
 Press off cap.
 Unscrew bolt (3).

Lift out cover.

Unscrew bolt (4).
 If applicable, pull off plugs for power windows, etc.

Lift the center console and remove the bearing ducts.



Turn retainer (5) and pull down the rubber cover.

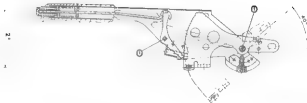
Unscrew adjusting nuts on parking brake lever.

Unscrew bolts (5) - (7).
 Remove parking brake lever.

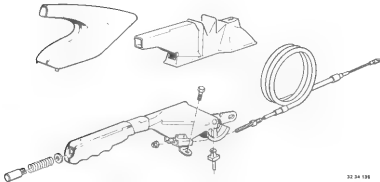
Be careful not to damage the warning switch while removing and installing.
 Insulation.
 Adjust parking brake - see 34-10-034.

PARKING BRAKE LEVER LAYOUT DRAWING

(1) = Flashed



32 34 104



32 34 104



34 41 100 REMOVING AND INSTALLING PARKING BRAKE CABLE

Remove expander lock with parking brake shoes - see 34 41 200
 Remove parking brake lever - see 34 41 000
 Unhook parking brake cable on trailing arm and (pull out)
 - see 34 41 010
 Adjust parking brake - see 34 10 014



34 41 200 REMOVING AND INSTALLING PARKING BRAKE SHOES

Remove rear brake disc - see 34 21 020
 Disconnect upper return spring with a brake spring pliers



Turn retaining springs 90° with Special Tool 34 4 000 and disconnect

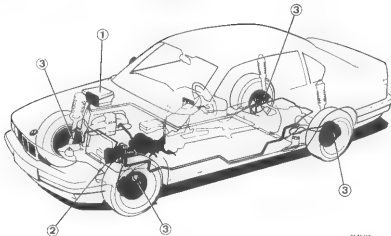


Pull brake shoes apart at top and remove from below
 (important!)
 Fit of expander lock could fall out
 Replacing Liners
 Break in as for replacement of brake discs
 - see 34 21 020



Check expander lock
 Pull part A forward.
 Press out pin B
 Pull out part C
 (important!)
 Stretch liner shell - never remove by blowing.
 Installation:
 Apply a thin coat of Molykote Paste G on sliding surfaces and pins.
 Adjust parking brake - see 34 10 014.

ABS LAYOUT DRAWING



DA 26 100

- 1 - Electronic control unit
- 2 - Hydraulic control unit
- 3 - Pulse sensors



DESCRIPTION OF FUNCTION AND CHECKING ABS CONTROL LAMP

The ABS control lamp lights up after switching the ignition on.
The control lamp must go out after starting the engine if ABS is okay.

The procedure is repeated each time the ignition is switched off and on.

The causes for faulty display — control lamp does not light up, does not go out or lights up while driving (even sporadically) — can be determined with help of a BMW Service Tester and brake test stand.

The control unit automatically switches to "conventional brake" in case of an electric or electronic fault in ABS.
This means that the car can still be braked, but without regulation (the wheels could lock).

The ABS control lamp in the dashboard lights up continuously to indicate a faulty system.

34-50 000 CHECKING FUNCTION OF

An electronic circuit in the control unit monitors ABS constantly. This function must be checked when ABS malfunctions lamp does not go out, comes on when is driving or does not come on when turning on the ignition or after performing jobs on ABS.

This function is checked with a BMW Service Tester.

Connect tester on wire harness and control unit with a portable plug.

Refer to ABS nominal value motorcycle.

Caution

Control unit plug may only be disconnected and connected after turning off ignition. See wiring diagram in ABS nominal value motorcycle for connection.

ABS Function and Troubleshooting:
See the electric/electronic test plan.

FIG. 34-52-1

Servicing ABS.

Usually the ABS does not require servicing. Check brake lines to and from the hydraulic unit for correct routing and leaks together with the general brake system.

34 51 528 REMOVING AND INSTALLING OR REPLACING COMPLETE HYDRAULIC CONTROL UNIT (FOR ABS)

Unscrew brake pipes (1) and (2)

Precaution

Pipe (1) to brake master cylinder, rear

Pipe (2) to brake master cylinder, front

Caution!

Catch escaping brake fluid and don't let it get on clothes or paint finish

Unscrew brake pipes (VL + VH - HL + HR)

Precaution

Don't mess up pipes (mark)

VL to left front brake caliper

VH to right front brake caliper

HL to left rear brake caliper

HR to right rear brake caliper

Important!

Keep open pipes and interconnectors closed (use plug)

Unscrew bolt (3). Turn T 15, and off all

center

Pull out plug (4).

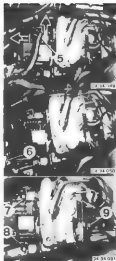
Pull off nutplate on plug (5) and module.

Unscrew ground lead (6)

Loosen nuts (7 - 8)

Pull up and remove hydraulic control unit.
Precaution

Check Function of ABS with a BMW Service
Tester - see 34 50 000



34 51 529 REMOVING AND INSTALLING OR REPLACING HYDRAULIC CONTROL UNIT FOR ABS (ABS)

After finishing work, bleed brake system
refer to 34 00 047 for ABS or 34 00 048 for
ABS-ASC-T

Disconnect battery ground lead
Refer to General Information in Group 01



34 51 100

Suck the brake fluid out of the brake fluid
tank using a siphon used exclusively with
brake fluids



34 51 100

Unscrew screw and remove cover



34 51 100

Unlock and pull off plug (1).
Unscrew nut (2) and remove ground wire



34 51 100

Unscrew brake pipes (7 .. 8).

Important!

Don't mix up brake pipes – mark them be-
fore disconnecting if necessary.

Note

Plug brake pipes and ABS control unit with
suitable plugs.

Installation

Tightening torque*

Brake pipes

3 (HL)	to left front brake caliper
4 (HL)	to right front brake caliper
5 (HR)	to right rear brake caliper
6 (HL)	to left rear brake caliper
7	to master cyl. conn. (H)
8	to master cyl. conn. (H)

Brake Pipes of Models with ASC-T

3 (HR)	to plunger inlet (HR ABS)
6 (HL)	to plunger inlet (HL ABS)



34 51 100

Loosen mounting nuts and remove ABS
hydraulic control unit.

* Refer to Specifications

34 51 520 Removing and installing or replacing complete hydraulic unit (for ABS) (M 50) (from model year '94)

When work is complete, bleed the brake system - refer to 34 50 047

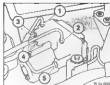
Disconnect negative lead from battery - refer to instructions in Gr 51*



Draw brake fluid out of tank with a suction bottle reserved for exclusive use with brake fluid



Unlock plug (1) and remove
Unscrew screw (2) and remove ground cable



Caution!

Do not confuse position of brake lines. If necessary, mark before disconnecting.

Unscrew brake leads (1 - 5)
Seal brake lines and ABS hydraulic unit with suitable plugs.

Brake line

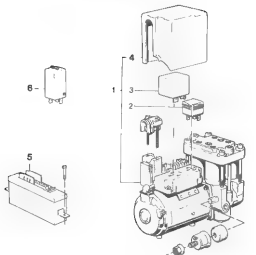
- 1 (V) from master brake cylinder, connection (V)
- 2 (H) from master brake cylinder, connection (H)
- 3 (VR) to front right brake caliper
- 4 (VL) to front left brake caliper
- 5 (HA) to rear right and rear left brake caliper

Tightening torque *



Unscrew screw and remove ABS hydraulic unit

ABS COMPONENTS



32 34 506

- 1 Hydraulic control unit
- 2 Valve relay
- 3 Motor relay

- 4 Cap
- 5 ABS electronic control unit
- 6 ABS electronic relay

34 51 525 REMOVE AND INSTALL OR REPLACE HYDRAULIC CONTROL UNIT FOR ABS/ESC (R&R)

After finishing work, bleed brake system refer to 34 00 048.

Disconnect battery ground lead Refer to General Information in Group 51

Remove hydraulic fluid supply tank refer to Group 32

Remove rear pedal assembly complete refer to Group 35



Unacross brake pipes (1 - 4) on plunger-type hydraulic control unit. Unacross and remove brake pipes (1) and (2) on ABS hydraulic control unit.

**INDICATION
Tightening torque***

Braze Pipes

- 1 Plunger inlet (R/L ABS)
- 2 Plunger inlet (R/L ABS)
- 3 Plunger outlet (R/L ABS)
- 4 Plunger outlet (R/L ABS)



Unlock and disconnect plug



Apply Special Tool 34 2 118 on bleeder screw. Loosen bleeder screw to discharge pressure to reservoir.



Unacross hydraulic pipe (5) at adaptor

Note

A second hydraulic pipe must be unacrossed at this position in mode with ride level height control.

Important!

Don't mix up hydraulic pipes, mark before disconnecting it necessarily.

**INDICATION
Tightening torque***

* Refer to Specifications



Unfasten nuts and remove upper wheel arch trim.



Unfasten retaining screws in wheel arch and remove lower wheel arch trim.

34 51-525 Removing and installing or replacing hydraulic unit (ASC-IT) (from model year 194)

When work is complete, bleed the brake system, refer to 34 90 000.

**Disconnect negative lead of battery
Observe general instructions in Gr 40***



Draw brake fluid out of tank with a suction bottle reserved for exclusive use with brake fluid.



Unlock and remove plug (1).
Unlock nut (2) and remove ground cable.



Caution!
Do not confuse brake lines. If necessary, mark them before removal.

Unlock brake lines (1) - (5).
Seal brake lines and hydraulic unit with suitable plugs.

Brake line:

- 1 (R) from master brake cylinder, connection (R)
- 2 (R) from master brake cylinder connection (R)
- 3 (RL) to front right brake caliper
- 4 (RL) to front left brake caliper
- 5 (RL) to rear right brake caliper
- 6 (RL) to rear left brake caliper
- 7 Diaphragm flow damper

Installation:
Tightening torque 34 32 1A.2*



Note:
Note installation position of the diaphragm flow damper.
The pin must fit in here.

Installation:
Tightening torque 34 32 1A.2*



Unlock screw and remove hydraulic unit.

* Refer to Technical Data

34 51 549 Removing and installing or replacing ASC +T filter

Filter replacement intervals, refer to 34 00 00.

When work is complete, bleed mineral oil circuit, refer to 34 00 048

If necessary, remove engine splash guard



Unseal Filter (oil housing) (1)
Replace Filter element and O-ring.

Installation
Tightening torque *



34 52 510 REPLACING CONTROL UNIT OF DR ABS

Uncover cover in engine compartment on right side

Caution

Only remove or install control unit after turning off the ignition



Push back clamp (1) and pull off right side and disengage left side of multiple pin plug (uncover control unit on body)



Check for correct connections when replacing the control unit

The multiple pin plug has a tab on the left side for which the control unit must have an opening

First engage the left side of the plug and then press the right side into the clamp

Check function of ABS with a BMW Service Tester see 34 50 000

Check the control unit number*

Also refer to Service Information of G1 34

Electrical work for ABS not completely integrated in the main work harness

* See Specifications



34-510 REMOVING AND INSTALLING OR REPLACING ONE FRONT PULSE SPEED SENSOR (FOR ABS)

Turn off ignition.

Unscrew socket head screw

Let wire out of hub

Pull out pulse sensor

into wheel

Check seal, replacing if necessary

Lubricate pulse sensor and housing with

Molykote Grease 2 prior to installation

Disconnect plug in engine compartment when replacing the pulse sensor. Turn and push down plug.

Important:

The spacing distance for front pulse sensors

is given by the take up bore.

Check function of ABS with a Blight Service Tester. See 34-50-000.



34-54-129



34-54-130

Removing and Installing/Replacing Front Pulse Wheel for ABS

Teeth of the pulse wheel are integrated in the front wheel hub.

See replacing wheel hub in 31-21-541.

Removing and Installing/Replacing Rear Pulse Wheel for ABS

The rear pulse wheel is integrated in the drive flange.

See replacing rear wheel bearings in 32-41-151.



34-520 REMOVING AND INSTALLING OR REPLACING REAR PULSE SPEED SENSOR (FOR ABS)

Turn off ignition.

Remove rear wheel. See 38-18-300.

Remove rear sensor. See 34-21-226.

Important:

The distance* between pulse sensor and pulse wheel (A) is given by design and cannot be adjusted.

However, the pulse wheel must be visually inspected for dirt or damage.

Unscrew socket head screw

Let wire out of hub

Pull out pulse sensor

into wheel

Check seal, replacing if necessary

Lubricate pulse sensor and housing with

Molykote Grease 2 prior to installation.

Replacing Rear Pulse Sensor

Take wires out of clamps.

Pull out wires and rubber grommet

Disconnect plug.

Take off pulse sensor

Important:

Don't damage the rubber grommet

* See Specifications



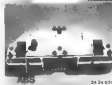
81 31 570 REPLACING RELAYS ON HYDRAULIC UNIT (FOR ABS)

Unscrew screw (1) (Torx T 35)
Pull off cover

Pull out engine relay (2) or valve relay (3)

Replacing Electronic Relay for ABS
Open cover on relay carrier in engine compartment (on left hand side)
Pull out ABS electronic relay (Bosch) with Special Tool 81 1 250 and replace

High Version Power Distributor
K 10 + ABS relay



82 95 000 REPLACING INDICATOR LAMP (FOR ABS)

Remove instrument cluster see 82 11 000

Pull out indicator lamp socket
Replace indicator lamp

Low Version Power Distributor
K 10 + ABS relay



TROUBLESHOOTING BRAKES

Condition	Cause	Correction
Brakes pull to one side	<ul style="list-style-type: none"> a) Tire inflation pressure incorrect b) Uneven tire tread wear c) Oil on pads/liners d) Pad/liner type not as specified e) Caliper recesses dirty f) Rear wheel alignment misadjusted g) Corrosion on calipers h) Shock absorbers without action i) Pad on one caliper worn j) Pad glazed 	<ul style="list-style-type: none"> a) Correct tire inflation pressure b) Change or replace tires c) Replace brake pads/liners and eliminate cause d) Replace brake pads/liners e) Remove sludge and install calipers f) Check/adjust wheel alignment g) Remove and inspect, repair or replace calipers h) Check or replace shock absorbers i) Replace brake pads, check calipers j) Replace brake pads, check calipers
Brakes excessively hot while driving	<ul style="list-style-type: none"> a) Compensation bore/master cylinder clogged b) No play between push rod and master cylinder piston c) Rubber parts swollen/brake contact with wrong type of brake fluid d) Vent hole in brake fluid tank clogged e) Corroded calipers f) Parking brake lever not released fully 	<ul style="list-style-type: none"> a) Check or replace master cylinder b) Adjust push rod c. Overhaul or replace master cylinder d) Clean brake fluid tank e) Remove and inspect, repair or replace calipers f) Check parking brake and parking brake cable, repairing if necessary
Braking effect insufficient (squeal or great force on pedal)		
Brake pedal travel normal		
short	<ul style="list-style-type: none"> a) Brake pads coated with oil or burnt, wrong type of brake pads b) Brake booster malfunctions 	<ul style="list-style-type: none"> a) Replace brake pads
long	<ul style="list-style-type: none"> c) One brake piston failed due to leak or damage 	<ul style="list-style-type: none"> c) Check seal on brake master cylinder, replacing if necessary Check brake booster Check brake system for leaks

TROUBLESHOOTING BRAKES

Condition	Cause	Correction
Brake pedal motion too soft and spongy	<ul style="list-style-type: none"> a) Air in brake system b) Insufficient brake fluid in brake fluid tank c) Overheated brake fluid - vapor lock due to excessive waste content in brake fluid or excessive brake loads 	<ul style="list-style-type: none"> a) Add or replace brake fluid and bleed brakes b) See a) c) See a)
Brake pedal travel excessive even though brakes have been bled and adjusted	<ul style="list-style-type: none"> a) Primary cup in master cylinder damaged b) Separating cups on floating piston of tandem master cylinder leak c) Leak in brake system 	<ul style="list-style-type: none"> a) Overhaul or replace brake master cylinder b) See a) c) Check brake system for leaks
Uneven pad wear	<ul style="list-style-type: none"> a) Wrong type of brake pads b) Caliper piston dirty - caps damaged c) Corrosion on calipers d) Rubber ring for piston control swollen 	<ul style="list-style-type: none"> a) Replace brake pads b) Remove and install - repair or replace calipers c) See b) d) See d)
Brake pads wear at angle	<ul style="list-style-type: none"> a) Wheel bearing play excessive b) Brake disc not aligned with caliper c) Corrosion on calipers d) Brake disc wear irregular e) Pads wear less than maximum thickness 	<ul style="list-style-type: none"> a) Replace wheel bearings b) Check caliper installation c) Remove and install - repair or replace calipers d) Grind or replace brake discs e) Replace brake pads

TROUBLESHOOTING BRAKES

Condition	Cause	Correction
Reduced brake pads - pads stuck on brake disc	<ul style="list-style-type: none"> a) Caliper pistons dirty - caps damaged b) Contamination of seal-pins c) Compensation bore in master cylinder clogged 	<ul style="list-style-type: none"> a) Remove and install, repair or replace calipers b) See a) c) Overhaul or replace master cylinder
Brake squeal or knock	<ul style="list-style-type: none"> a) Wrong type of brake pads b) Caliper pistons dirty c) Brake disc not aligned with caliper d) Brake disc runout e) Excessive thickness deviation on the braking surface f) Rust on edges of brake discs g) Pad noise h) Wheel bearing play excessive 	<ul style="list-style-type: none"> a) Replace brake pads b) Remove and install - repair or replace calipers c) Check caliper installation d) Check brake disc runout, replacing discs if necessary e) Measure brake disc thickness and grind or replace f) Grind or replace brake discs g) Replace brake pads h) Replace wheel bearings
Brake pedal (stop travel) is spongy	<ul style="list-style-type: none"> a) Wheel bearing play excessive b) Brake disc not aligned with caliper c) Brake disc runout d) Excessive thickness deviation on the braking surface e) Brake system has a leak f) Air in brake system g) Wrong type of brake discs 	<ul style="list-style-type: none"> a) Replace wheel bearings b) Check caliper installation c) Check brake disc for runout, replacing if necessary d) Measure brake thickness deviation and grind or replace discs e) Check brake system for leaks f) Bleed brakes g) Replace brake pads

TROUBLESHOOTING BRAKES

Condition	Cause	Correction
Brakes operate in calipers	<ul style="list-style-type: none"> a) Caliper pistons dirty, cups damaged b) Brake disc not aligned with caliper c) Corrosion of pistons or calipers 	<ul style="list-style-type: none"> a) Remove and install, repair or replace calipers b) Check caliper installation c) See a)
Parking effect on brake pedal	<ul style="list-style-type: none"> a) Wheel bearing play excessive b) Brake disc not aligned with caliper c) Brake disc runout d) Excessive thickness deviation within braking surface 	<ul style="list-style-type: none"> a) Replace wheel bearings b) Check caliper installation c) Check brake discs for runout, replacing if necessary d) Measure disc thickness and grind or replace
Parking brake effect insufficient	<ul style="list-style-type: none"> a) Oil on brake shoes b) Excessive dead travel between brake shoes and brake drums c) Excessive dead travel in cables d) Cables misadjusted e) Corroded transmitting elements 	<ul style="list-style-type: none"> a) Replace brake shoes and eliminate cause b) Adjust parking brake c) See b) d) See b) e) Remove and install parking brake and expansion links, check cables, replacing if necessary

35 Pedals

	Notes	35-	0/1
	Arrangement of pedals	35-	0/2
	Control dimensions for spacing between pedals	35-	0/3
35 11 000	Console for pedals - complete unit - remove and install	35-	11/1
001	Console for pedals - replace	35-	11/2
35 21	Pull rod for brake actuation - adjust	35-	21/1
	Brake pedal - adjust	35-	21/1
000	Brake pedal - remove and install	35-	21/2
051	Console for brake system - remove and install or replace	35-	21/3
055	Console for pivot lever - remove and install or replace	35-	21/7
35 31 000	Clutch pedal - remove and install	35-	31/1
35 41 000	Accelerator pedal - replace	35-	41/1
010	Accelerator pedal shaft - remove and install/replace	35-	41/1
421	Bowden cable for throttle valve actuation - replace	35-	41/2
	Bowden cable for throttle valve actuation - adjust	35-	41/4
	Bowden cable for throttle valve actuator - adjust (on ASC+T)	35-	41/4
480	Kick-down switch - replace (EH transmission)	35-	41/5

GENERAL INFORMATION**Cars with Interlock System**

The following function test must be carried out if a component of the interlock system has been removed and installed or the position of the interlock cable changed:

- 1 Move selector lever of automatic transmission into "P"
- 2 Remove ignition key
- 3 Press lock button on selector lever
- 4 If the selector lever can be moved out of "P" the interlock cable must be adjusted - refer to Group 25
- 5 Switch on ignition
- 6 Press lock button on selector lever
- 7 If the selector lever cannot be moved out of "P" the interlock cable must be adjusted - refer to Group 25

PEDAL ASSEMBLY LAYOUT DRAWINGS



Brake Pedal



Clutch Pedal

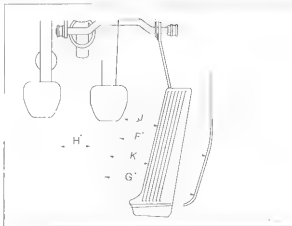


Clutch Pedal

* Refer to Specifications

* Refer to Specifications

DIMENSIONS TO CHECK SPACES BETWEEN HOUSING





35.19.000 REMOVING AND INSTALLING COMPLETE PEDAL CONSOLE

Remove accelerator pedal shaft - refer to 35.41.000
 Remove complete steering column - refer to 35.30.000
 Remove clutch master cylinder - refer to 35.52.000

Adjusting Clutch Pedal Eccentric Bolt
 Turn eccentric bolt until bolt on bolt is opposite the clutch master cylinder

Insulation

Distance (B') must be reached.
 Distance (B') is not reached in the above mentioned equipment. Turn eccentric bolt 180°

Important

Intermediate positions of the eccentric bolt are not acceptable



Put off plugs (1 and 2)

Version with Automatic Clutch Control
 Disconnect plug (3)



Version with Electronic Pedal Value Sender

Disconnect plug

* Refer to Specifications



Lift out master (1) and pull out shaft (2)



Insulation

Adjust brake pedal at brake master cylinder (push 40°) to distance (A*)
 Adjust brake light switch - refer to 35.31.000

Important

Movement must be limited to the brake master cylinder and not, for example, by the brake light switch (distance "B")

Check function of brake signal



Lubricate the shaft on engine compartment wall

Warning

Replace the bolt with right tightening torque



Unscrew bolts at top
 Remove pedals

Insulation

"Tightening torque"
 Lubricate all sliding surfaces lightly with grease**

* Refer to Specifications

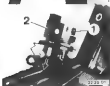
** Refer to Operating fluids



35-11-001 REPLACING PEDAL CONSOLE

Remove pedal console - refer to 35-11-000

Refer to Group 12 for information on removal, installation and adjustment of the pedal valve sender



Transfer brake light switch (1) and brake light switch (2)

Note

Punger and stems must be protected not to remove brake light switch (2)
Compress retainers and (pin) out switch

Installation

Mount switch with protruding wire inserted into opening in holder



Precaution

Check for correct installed position of spring (9)



Transfer spacer (10) and bearing sweep (11)

Check bearing stems, replacing them if necessary

Greasing Note

All sliding surfaces must be given a light coat of grease**



Transfer steering coupler lever (3), clutch pedal (4), together with spacer (10) and over center spring (11) as well as brake pedal (7) together with spacer (8) and spring (9)

** Refer to Operating Manual

**35 21 ADJUSTING BRAKE OPERAT
ING PULL ROD**

35 21 ADJUSTING BRAKE PEDAL

Requirement
Correct adjustment of brake operating pull rod - refer to 35 21

Remove dashboard trim panel at bottom left - refer to Group 31



Loosen nut (1) using Special Tool 13 5 034
Turn pull rod (2) until distance "A" is reached

Note
Check for correct seating of rubber plug (2)



Counterhold on pull rod (2) and tighten nut (1) using Special Tool 13 5 034
Tightening torque*

Check distance "A", repeating the adjusting procedure if necessary

Note
Support was removed for better illustration

Check brake pedal adjustment - refer to 35 21



Loosen nut (1).
Turn pull rod (2) until distance "A" is reached

Counterhold on pull rod (2) and tighten nut (1)
Tightening torque*

Check function of brake lights and adjust
range of brake light switch, adjusting it if
necessary - refer to Group 31



35-19 800 - REMOVING AND INSTALLING BRAKE PEDAL

Remove dashboard trim panel - at bottom
 with - refer to 35-45-180
 L-R (but not center) (4) and pull out trim (6)



Adjustment

Adjust brake pedal at brake master cylinder
 at push rod (7) to distance (A)
 Adjust brake light switch - refer to 35-45-1

Important

Master cylinder will be fitted in the brake master cylinder and not, for example, by the brake light switch distance "B"

Check function of brake light



Break spring (8)

Remove nut (7) and pull out steel ball as far as clutch pedal
 Return brake pedal together with spacers and spring

Important

Tightening to "B"



Check installed position of spring (8)

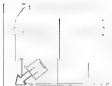
Installation

Lubricate all sliding surfaces with grease*

* Refer to Specifications
 * Refer to Operating fluids

35-21-001 REMOVING AND INSTALLING OR REPLACING CONSOLE FOR BRAKE BOOSTER

Remove air headlight - refer to Group 63.



1. If out of order and remove brake fluid tank.
Suspend tank from car on piece of rope.

Caution:

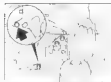
Don't bend supply pipes or the brake master cylinder.

Don't let supply pipes to break up master cylinder out of seal or brake master cylinder.

Keep brake fluid off of painted surfaces on car as it would destroy the paint finish.



2. Unlock retainer for pipe to oil supply tank.
Unscrew nut.



3. Unscrew screw.
Remove support.

Note:
View from front passenger's side.



4. Loosen nut (1) of pull rod (2) using Spec 11
Torx T30.
Screw pull rod out of nut or heads and
remove.



5. If out of order and pull out shaft.



6. Unscrew brake booster mounting nuts.

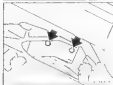


Remove master for brake pipes



Unscrewed nuts

Note
View from front passenger's side



Unscrew nuts



Remove ABS hydraulic control unit mounting nuts and the ABS hydraulic control unit out of holder

Caution
Don't damage the brake pipes!



Push brake booster towards front wall and remove console

Caution
Don't damage the brake pipes!



Install console

Screw on nuts, but do not tighten!
Replace self locking nuts



Screw in screws, but do not tighten

Note
View from front passenger's side



Place ABS hydraulic control unit in holder and tighten nuts and screws
Tightening torque*

* Refer to Specifications

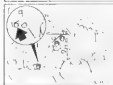


Install support
Screw in screw, but do not tighten

Note
View from front passenger's side



Screw in and tighten screws
Tightening torque*



Tighten screw
Tightening torque*



Tighten nuts
Tightening torque*

* Refer to Specifications



Tighten screws
Tightening torque*

Lock retainer for pipe to oil supply tank



Place brake booster in console and tighten nuts
Replace self locking nuts
Tightening torque*



Secure holder for brake pipes

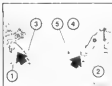
Important
Check for correct routing of brake pipes
Brake pipes must not rub



Insert shaft and install retainer

Important
Check for correct seating of lock retainer
Replace if damaged retainer

* Refer to Specifications



Insert pull rod (3) and its two universal joints (1 and 2)

It is not

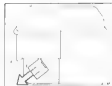
Indication

R_h (rod) and universal heads have left-hand and right-hand threads

Important

Check: installed position of pull rod (3)
Sustainer (5), for counterholding pull rod (3) are located at the reversing level outside and

Ensure sufficient and uniform spread: in depth of the pull rod in the universal joints



Install brake fluid tank and brake master

Important

Check for correct seating of reservoir
Replace a damaged reservoir

Check for correct routing of brake pipes.
Brake pipes must not rub

Check for correct seating of supply pipes
on brake master cylinder and on brake fluid tank

If necessary, reconnect brake pipes and
then bleed the brake system - refer to
Group 34



Turn pull rod (3) until distance (A)* is reached

It is not

Note

Check for correct seating of rubber stop (3)

Check function of brake lights and adjustment of brake light switch, repeating it if necessary - refer to Group 61



Counterhold on pull rod (3) and tighten nut (10) using Special tool 13.8.000
Tightening torque

Check distance (A)* repeating the adjustment if necessary

* Refer to Specifications

35-21-005 REMOVING AND INSTALLING THE REVERSING CONTROL FOR REVERSING LEVER

Remove dashboard trim plate at bottom
Refer to Group 31



Unlock detainer for pipe to oil supply tank
Detainer at 1 mm



Use the wire
Remove support



Loosen nut (1) of pin rod (2) using Spec oil
Tool: 35-21-002
Unfasten and remove pin rod in panel
Refer to



Lift out register and pull out shaft



Uncover nuts on engine compartment wall
Take oil bender and remove console



Check gasket (1) for console or Firewall
Replacing if necessary

Wash console and mount sections

Insulation
Check for correct seating of benders



Replace and tighten self-locking nuts on
engine compartment wall
Tightening torque*

* Refer to Specifications



Insert chain and install retainer

Important!

Check for correct seating of retainer

Replace a damaged retainer



Insert pull rod (3) and screw uniformly into both pivot heads (1) and (2)

4 x 16"

Installation

Pull rod and screw heads have left-hand and right-hand threads

Important!

Check installed position of pull rod (3). Surfaces (d) for counterbalancing pull rod (3) are located at the reversing lever controls and

5 ft/min pull speed and uniform oil speed in depth of the pull rod in the pivot head



Install support

Screw in screw (but do not tighten)

4 x 16"

View from front passing at a side



Screw in and tighten screws

Tightening torque

Lock retainer for pipe to oil supply tank

4 x 16"

Support must not be installed with tension. If necessary correct the centering of the brake booster linkage



Tighten screw

Tightening torque



Turn pull rod (2) with distance (4) in

4 x 16"

4 x 16"

Check for correct seating of rubber stop (3)

Refer to Specifications



Countershold on pull rod, 2) and again out
 ("Using Bar of Test 12 5 000
 Tightening torque"

Check distance (8) repeating the adjustment if necessary

Check adjustment of brake pedal correct
 Fig. 1 Preliminary item 35 21
 Check function of brake light and adjustment of brake light switch connecting it if necessary refer to Group 61



35 31 000 REMOVE CLUTCH AND BRAKE, NO CLUTCH PEDAL

Remove dashboard trim panel as shown
left: refer to 35 45 180
Remove accelerator bolt (1)

Make a wire with automatic chassis cones
using new holder for clutch pedal
Tighten and adjusting: refer to Group 45

Tightening torque*
Adjust the accelerator bolt tightly before
mounting on

Adjusting Clutch Pedal Excessive Bolt
Turn accelerator bolt until stop on both to
expose the clutch master cylinder



Distance (B) must be reached
If distance (B) is not reached in the above
dimensioned adjustment turn accelerator bolt
(100)

Fig. 10.1
Insert into a portion of the accelerator bolt
and hold in operation

Mount on
Engage over-center spring (2) in guide on
pedal assembly before inserting pinion rod
(3)



Put out master (4) and put out shaft (5)



Fig. 10.1
Adjust the pedal of brake master cylinder
push rod (7) to distance (A)
Adjust the right switch: refer to Gr. 51

Fig. 10.1
Movement must be limited in the brake
master cylinder and not, for example by
the brake right switch: distance (B)

Check function of brake lights*



Detach spring (8)
Unscrew nut (7) and pull out shaft bolt

Fig. 10.1
Tightening torque*

Remove clutch and brake pedals together
with spacers, over-center spring and spring



Check installed position of spring (8)

Fig. 10.1
All sliding surfaces must be lubricated
with grease*

35-41 000 REPLACING ACCELERATOR PEDAL

NOTE:

Always replace a removed accelerator pedal.
Retainers of the coil spring could be damaged and let the accelerator pedal slide out of the connecting.
Danger of accident!

Push down on large
rubber heel caps and remove accelerator
pedal by pulling up.

STEP 1

Insert accelerator pedal with pedal over
the connector on the floor plate and ensure
engagement of the retainers.

IMPORTANT

Always check for correct engagement of
the coil springs.

Turn accelerator pedal (1) far enough that
bushing tab (2) on the accelerator shaft
engages in opening (3).
Pull accelerator pedal (1) on accelerator
shaft.

On shaft (1)
Lubricate sliding parts of accelerator
shaft lightly with grease **

** Refer to Operating Points



35-41 010 REMOVING AND INSTALL MO OR REPLACING ACCELERATOR FOR PLUG, SHAFT

Remove dashboard trim panel at bottom
left corner (1) at 35-100
Disconnect throttle cable (2)

CAUTION

Check rubber gasket, replacing it if
necessary.

Lift out retainer (2)



Loosen up lag (2).
Move bearing sleeves (4 and 5) to the side
Lift out accelerator pedal shaft.

CAUTION

Check bearing sleeves, replacing them if
necessary.
All sliding surfaces must be lubricated
lightly with grease**

Turn accelerator pedal shaft and guide (4)
(5) through opening (3) in accelerator pedal
(1).



** Refer to Operating Points



35-41 000





35-41 431 Replacing bowden cable for throttle valve actuation

Remove speed upfl from top of instrument panel (refer to Group 54)

M 40

Refer to Repair Manual 3 Series 1.30

Remove Bowden cable from pedal shaft



1/11 411 10000 (2)
Unthread nuts (2)

Insulation
Tightening torque

If necessary, remove grammel from Bump
mat Bowden cable

Remove manifold cover



M 35, M 36

Left locating nipple (1) off throttle valve lever



Press nipple out of nipple mounts

Remove Bowden cable out of nipple mounts



Detach Bowden cable from bracket on firewall



1/11 411 10000 (2)
Unthread nuts (2)

Remove Bowden cable from bore



Press together retaining lugs and withdraw
Bowden cable from engine forward in direction
of engine compartment



M 35

Compress nipple mounts on both sides and
press out of operating lever

Note

If take pipe was removed for picture to im-
prove demarcation

Refer to Technical Data



Press nipple out of nipple holders
Take cable out of nipple holders



Put out nipple using a screwdriver
Pull out cable towards rear
Take rubber pad out of holder

Guide in cable completely as far as stop



Survey of 1st lead Cable to Throttle Valve

- 1 Nipple
- 2 Throttle cable
- 3 Cap
- 4 Rubber pad
- 5 Sleeve
- 6 Screw



and
Take cable out of holder for collector cover
10



Compress nipple holder on both retainers
and press out of opening lever



Pull out cable towards rear
Take rubber pad out of holder

Guide in cable completely as far as stop



Survey of 1st lead Cable to Throttle Valve

- 1 Nipple
- 2 Throttle cable
- 3 Rubber pad
- 4 Sleeve
- 5 Screw
- 6 Spring



Install with Cruise Control
Reattach cruise control cable at underneath
throttle cable (1)

35-41 Adjusting bowden cable for throttle valve actuation

Throttle cable adjusting procedure

Manual transmission

- 1 Fully depress accelerator pedal
- 2 Move throttle valve into idle setting
- 3 Adjust bowden cable with no tension
- 4 Set adjusting screw on full throttle detent adjust pedal so that 0.5 mm of clearance is still present at full throttle detent of throttle valve when accelerator pedal is fully depressed (symptoms adjusting screw 1.5 turns equivalent to 0.5 mm clearance)
Lock full throttle stop with nut

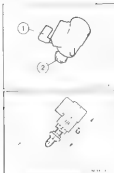
Automatic transmission

- 1 3 sec for manual transmission
- 2 Check injection synchronizer C
- 3 Adjust full throttle detent so that a 100% full lock down setting full throttle detent there is a clearance of 0.5 mm at the throttle cable connection full throttle detent 1.5 turns screw will be clearance of 0.5 mm
Lock full on lock down detent
- 4 Depress accelerator pedal until transmission pressure point and adjust idle valve at 1/2 throttle detent in such a way that the transmission pressure point reaches the 1/2 throttle detent

35-41 Adjusting bowden cable for throttle valve actuator (on ASC+T)

Bowden cable must be set with no clearance at throttle

Perform adjustment using adjusting screw



35-41-500 88764605 88764605
SAW PCN (EM Transmission)

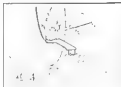
Tuning - refer to 8866 Test Plan for
Group 34

Put off the male plug (1),
Unscrew nut (2)
Increase switch

Position on
Adjust nut to control distance C?
Make if not adjustment after installation
if slipping tongue?

36 Wheels and tires

36 10 006	Front wheel, left or right – balance electronically	36-	10/1
056	Rear wheel, left or right – balance electronically	36-	10/2
209	Wheel – check lateral and radial runout	36-	10/3
300	Wheel, front or rear – remove and install	36-	10/4
506	Wheel – balance dynamically	36-	10/5
713	Wheel, front or rear – check for lateral and radial runout	36-	10/6
715	Wheel rim – check for lateral and radial runout	36-	10/7
36 12 01	Tire for front, rear or spare wheel – replace	36-	12/1
081	Tires for all wheels – replace	36-	12/4
36 13	Wheel bolt lock – service/install	36-	13/1
551	Wheel rim blades – remove and install or replace	36-	13/2



36-10-000 BALANCING LEFT OR RIGHT FRONT WHEEL, ELECTRONICALLY (Finish Balance)

Always finish balance wheels static only prior to electronic balancing. See 36-10-100.

Set up gauge for balancing on the control arm end.

Use a suitable take-up fork or additional fork (see Service Information or Workshop Equipment list).

Set up gauge on control arm as close as possible to the control arm end.



Connect leads for tester

Important!

Balance wheel to the instructions supplied with the balancing machine. Balancing must be carried out on a solid base (concrete floor without a basement or sublevel underneath). Also refer to Service Information of Group 36.

If more than 15 grams of imbalance are displayed during finish balancing, the possible causes (e.g. insufficient stationary balancing, centering pin etc.) also refer to Service Information 36-0-483 (199) must be eliminated prior to finish balancing and the final balanced wheel rechecked.



Make a chalk mark on the side of the rim opposite the valve.



36-10-056 BALANCING LEFT OR RIGHT REAR WHEEL ELECTRONICALLY (CALLY) (Finish Balancing)

Always first be sure wheel is stationary (see 36-10-508) prior to electronic balancing.

Unscrew and suspend output shaft from car on a piece of wire.
Set up gage for balancing on railing and as close as possible to the wheel.



Connect leads for tester.

Important

Balance wheel according to the Manual. Make sure it is with the balancing machine.

Balancing must be performed on a solid foundation (concrete floor without cables).

Also refer to Service Information of Group 36.

If more than 15 grams of imbalance are displayed for one wheel during finish balancing, the possible causes (e.g. inaccurate stationary balancing, centering, etc.) also refer to Service Information 36-0-883 (100) must be eliminated before finish balancing and a previously finish balanced wheel must be rechecked.



Make a chalk mark on the side of the line opposite the valve.



36-10-205 CHECKING WHEEL FOR LATERAL AND RADIAL RUNOUT

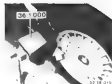
Wheel bearings must be in perfect condition.
 1.91 car
 Check wheel for lateral runout* with Spec at Tool 36-1000



Check wheel for radial runout* with Spec at Tool 36-1000



If necessary, remove balance weights.
 Pry off the ornamental ring, if applicable.
 Check lateral runout* of rim with Special Tool 36-1000.



Check radial runout* of rim with Special Tool 36-1000

36-10-300 REMOVING AND INSTALLING FRONT DRIVE/REAR WHEEL

Important:

Wheels were balanced electronically. Use the following procedures to avoid transferring wheels and imbalances.



36-20-008

The wheels must run in a certain direction due to the blade wheels. Identical location of the wheel running direction is provided on the surface of the blade wheels shown by the arrow.

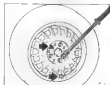
- L = Left
- R = Right



Loosen wheel bolts.

Position wheel with valve at bottom and install in same position.

- If paired wheels are removed at the same time, mark installed location of wheels in line with chalk.
 - Mark position of wheel to wheel hub (to avoid transferring errors).
 - Mark position of wheel bolt to wheel (to avoid imbalances).
- Unscrew wheel bolts.



Tighten wheel bolts crosswise. Tightening torque*

If paired wheels are mounted for the first time, the tightening torque* must be checked.

Place a pertinent information label or tag in car where the driver can see it.



MS Wheel

Press the filler emblem in against the spring latch.
Grab hold of the hub cap with fingers and push it through the middle openings and pull the cap off towards the outside.



- a) Wheel bolt galvanized
- b) Wheel bolt black chrome plated
- c) Wheel bolt black or chrome plated and lockable (select equipment)

Note for Wheel Bolt Locks
If the adapter is missing, use a suitable adapter from the wheel bolt adapter set, Special Tool 36-1-300, to unscrew the locked wheel bolts.



Installation

Remove dirt and oil grease from the wheel centering shoulder and rim bearing surface and coat wheel center with "Fuchslipe" before installing a wheel.

Inspect wheel bolt threads and tapered for wear. Repearing wheel bolts if necessary. Lubricate wheel bolt threads lightly with grease, but keep grease off of the tapered.

* Refer to Operating Fluids

Refer to Specifications



36 10 508 BALANCING WHEEL DYNAM- CALLY (Wheel Removed)

Remove old balance weights, stones, in
treads and large pieces of dirt.
Check inflation pressure and time for
damage or flat spots (caused by park-
ing a car with hot tires for a long time).
If necessary, check wheel and tire for
radial and lateral runout - see
36 10 509

Use a suitable center of pertinent bal-
ancing machine supplier

- 1 = Basic Range
- 2 = Carrier
- 3 = Type Range

Also refer to Workshop Equipment and
Planning



12 38 014

Important!

It is necessary to mount the wheel on
the balancing machine in the same
manner as it will be mounted on the
car afterwards (e.g. valve facing down),
in order to avoid clamping-on errors.
Balance wheel according to the instruc-
tions supplied with the pertinent bal-
ancing machine.

Push the tire wall away from the rim
slightly with a tire pliers** at a
suitable point and insert a retainer in
the case of light alloy rims.
Remove the tire pliers and slide a bal-
ance weight underneath the retainer
and let it engage.

** See Workshop Equipment and
Planning



Arrangement of Balance Weights for Cast Light Alloy Wheel Rims

- 1 = Spring clip
- 2 = Balance weight

Max. imbalance per wheel and side*

Arrangement of Balance Weights for Steel Wheel Rims

Max. imbalance per wheel and side*

* See Specifications



30 18 043



36 10 113 CHECKING FRONT OR REAR WHEEL FOR RADIAL OR LATERAL RUNOUT (Wheel Removed)

Remove wheel – see 36 10 300.
Mount wheel on the balancing machine in the same manner as it will be mounted on the car afterwards (e.g. valve facing down), in order to avoid clamping-over errors.

Use a suitable center of the pertinent balancing machine supplier

- 1 = Basic Range
- 2 = Center
- 3 = Type Range

Also refer to Workshop Equipment and Planning.

36 10 014



36 1 000



36 1 000

Apply Special Tool 36 1 000 on tread surface of the tire.
Turn the wheel by hand and measure the max. radial runout*

Note:
Special tool must be perpendicular to the tread surface of the tire

Apply Special Tool 36 1 000 on side wall of the tire.
Turn the wheel by hand and measure the max. lateral runout*

Note:
Special tool must be perpendicular to the tire's side wall.
Don't measure on the printed surface!

If necessary, check radial and lateral runout of the wheel rim – see 36 10 715

36 10 715 CHECKING WHEEL RIM FOR RADIAL AND LATERAL RUNOUT

Remove wheel - see 36 10 300

Put tire off of wheel rim

Remove old balance weights

Remove dirt on rim wall and rim flange



Apply tester on rim flange

Turn wheel rim by hand and measure maximum lateral runout¹

Perform test on both rim flanges

Note

Dial gage must be perpendicular to the rim flange



Mount wheel rim on balancing machine



Use a suitable center for permanent balancing machine

1 Basic flange

2 Center

3 Type flange

Also refer to Workshop Equipment List

36 10 114



Apply dial gage on rim wall

Turn wheel rim by hand and measure maximum radial runout¹

Measure runout on both sides of the rim wall

Note

Dial gage must be perpendicular to the rim wall

36 10 301

¹ See Specifications

¹ See Specifications



35 13 501 Replacing tires for front wheels, rear wheels or spare wheel

Note Service Information Group 35
Asymmetric rims, refer to 35 12 261

Refer to the Operating Manual for the relevant tire-fitting device for instructions on how to fit tires correctly. Also make sure that the tire chain is in perfect condition and that the wheel rim and tire are not damaged.

General tire removing fitting instructions

Refueling

To remove a tire: first remove the valve.
After the tire has been forced off the rim flange remove it by pulling it up. Press the bulges into wall and apply good coat of tire mounting paste.
Clean wheel rim thoroughly and inspect rim for damage before mounting the tire.
The valves and valve insert must be replaced each time a tubular tire is removed and in

Assembly

Coat the tire rim with tire mounting paste.
Make sure tire is mounted on correct side, especially in case of asymmetric rims.
The outer side of these tires is marked.
Mount tire with minimum possible inflation for the rim because otherwise there is a risk of damaging the tire or the rim flange in the case of TD tires.

On TD tires, start assembly on the side opposite the valve.
Allow the tire bead - coming from the wall - to first clear the hump of the rim shoulder.
Build up pressure gradually, maintaining constant watch.

Maximum "pumping pressure" 13 bar.

If the tire is not seated on the rim correctly in the first place, tire seating will not be improved by simply increasing the inflation pressure.
Instead it will be necessary to press off both tire beads, apply another coat of mounting paste and remount the tire.

Only when the tire beads are securely located on the rim shoulders, slowly increase inflation pressure to enable the tire to seat down.

Maximum "seating pressure" 4.0 bar.

After pumping up the tire perform a visual inspection of tire seating, assessed on the basis of bead characteristics.

For approved tires, tire sides and special equipment refer to Service Information Group 35.

Caution*

TD tires may only be mounted on TD rims.
If incorrectly mounted TD tires or rims for other tire designs (e.g. using TR) are used, damage can be caused to tires which may cause them to fail in service.
Types of tire and rim must not be mixed, not even on a TP rim.

Caution*

It will be necessary to break the bead at several points on the bead periphery from the inside and outside with the pressing-off blade on the rim flange before pressing off the tire.
If it is very difficult to press off the tire, loosen tire from rim flange as well as possible with the pressing-off blade and then apply a coat of tire-mounting paste between the tire and rim flange.
Repeat this procedure around the entire circumference of the tire.
Then press off tire completely.

TD tires require higher levels of force for removal because their rim flanges are slightly higher.

Caution*

TP rim tires can suddenly jump into the Deflate groove, causing the forcing-off blade to deflect > 90 degrees.



Mounting Tree with a Mounting Machine

Underline valve and deflate tire.
Press off bead from rim flange all around on outside and inside using pressing-off beam of machine.

If tire beads fit too tight, first only loosen two inner flange at several points with the pressing-off beam prior to the above pressing-off.

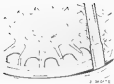
Push both tire beads into rim well completely until they are loose. Pull on particles on right or rim and clean rim to remove large pieces of dirt. Coat the beads with mounting paste**.

Clamp wheel on mounting machine. Narrow rim shoulder always faces up.



Let mounting machine run back a short distance (counterclockwise) so that the tire bead can slide fully on to the mounting finger.

Then let mounting machine run forward (clockwise) a short distance in so doing always (stop), whether the bottom bead is fully in the well and the tire is clean enough time to move. Stop the machine and let it run back slightly. If the bead clamps



Setting mounting pillar into position or fold and let it set again.

Adjust mounting head, whereby it must be released on the rim edge fully and turn down the lever for the clamp. Normally the distance of the mounting head will set in automatically.

Water hole, if it be about 10 cm to the right of the mounting head.

Lift the bead over mounting finger using the lever.

It is recommended to use coated or skinned in hose cleaned tire cone for tight alloy rims.



If the upper bead is pulled off at the rim now it is in the bottom bead over the mounting finger with the tire lever.

Let machine run back a short distance again and then forward clockwise briefly, until there is complete separation of the tire from the rim.



Release lock and tilt back or swing away the mounting pillar.
Uncrimp and clean the rim.
Replace the valve.
Coat the rim flange and tire beads with mounting paste.
Clamp the rim on the mounting machine.
Slide it to the rim with the lower bead over the rim flange partially.
Valve is 10 cm to the right of the mounting head.



Press the upper tire bead underneath the mounting finger.
The bead should seat in square next to the mounting finger.

Important:
Don't pinch or damage the bead.

Run the mounting machine forward (clockwise) a short distance while checking that the lower tire bead remains in the seat.



Swing or tilt the mounting pillar into position and lock.
Check adjustment of the mounting finger, readjusting if necessary and clamp.
Press the tire underneath the mounting finger by hand.
The bead should seat in the roll next to the mounting finger.
Let the mounting machine run forward (clockwise) a short distance.
The lower tire bead will drop into the seat.



After mounting, first release the clamps and then inflate the tire (with valve).
Increase pressure up to 2.2 bar in steps, jumping pressure.
If the tire bead does not slide on to the rim edge all around, do not increase the pressure.
Instead the tire must be deflated and the tire bead pressed on, then coat the rim flange with mounting paste again and inflate again up to 2.2 bar.
If the beads seat perfectly on the rim shoulders, increase the pressure to the utmost 4.0 bar to "test" the tire.
Screw in the valve and correct the tire pressure.

36-12-081 REPLACING TIRE OF A... RUC13.5

Valve for "asymmetric hump rim"

Reposition of Asymmetric Hump Rim
There will be "AM" or "AM 2" after the rim
size data in the wheel disc.

Example
8 J x 17 AM 2

Feature of Asymmetric Hump Rim

The profile of the hump changes around
the periphery of the rim.
The provided sections where removal of
the tire is easier.

- A Rim profile in area of valve with
flat hump profile
- B Rim profile about 180° from valve with
steep hump profile

Removing Tire

The removal of tires from asymmetric hump
rims is different.

The pressing of the tire from the inner
and outer rim flanges must always be
begun at the valve seat.
The spring over of the tire bead is easier
due to the flat hump profile.

Otherwise the procedures are the same as
for tires on symmetric hump rims.

Installing Tire

The installation of tires on asymmetric
hump rims is different.
A bead compressor* should be used to
install.

Maximum "jumping pressure" 3.5 bar
Release the pressure if the tire beads have
not jumped over the hump with 3.5 bar
pressure.

Coat the beads with tire mounting paste*
again, reposition the tire and inflate the
tire again.

Otherwise the procedures are the same as
for tires on symmetric hump rims.





36-13 SERVICE INSTALLING WHEEL BOLT LOCK

Loosen wheel bolts

Lift car until wheel can be turned
Loosen wheel bolts until wheel can be
moved easily on the wheel hub
Have valve of wheel face down
Remove top wheel bolt and install the
wheel bolt lock

Imbalance could be produced by play
in the wheel center and actual weight
of the wheel

This imbalance is kept at a minimum
by installing the slightly heavier wheel
bolt lock in the position of the top
wheel bolt

Tighten the wheel bolts hand tight
crosswise in this position (wheel bolt
lock at top and valve at bottom)
Lower car and tighten wheel bolts
crosswise
Tightening torque*

Wheels will have to be 10% balanced
if a customer complains about wheel
imbalance after installation of wheel
bolt locks

* See Specifications



36-13/21 REMOVING AND INSTALLING OR REPLACING BLADES ON WHEEL RIM (Wheel Removed)

Unscrew bolts.
Take off inner and outer blades.

* See Spec.
Tightening torque*

36-13/22

Only install blades with identical identification (see arrow)

L = Left
R = Right

on gag wheel

1 = Inner blades
2 = Outer blades

36-13/23

Important:
Install outer blades without servomotor in such a manner that the blades face forward at an angle in the turning direction of the wheel and are parallel to the inside blades.



37 Integrated suspension systems

	General information	37-	0/1
	Ride level control with LAD / circulating system – layout drawing	37-	0/2
37 12 010	Car ride level height – adjust	37-	12/1
100	Rear spring str./ shock absorber assembly left or right – remove and install	37-	12/3
210	Ride level height control valve – remove and install or replace	37-	12/4
37 14 005	Wheel camber warning switch –check (with BMW Service Tester)	37-	14/1
510	Wheel camber warning switch –replace	37-	14/2
37 21 005	Ride level control pump – check	37-	21/1
030	Pressure reservoir, left or right – replace	37-	21/2
500	Charge pressure in left or right pressure reservoir – check	37-	21/3
	Ride level control with LAD – troubleshoot	37-	90/1

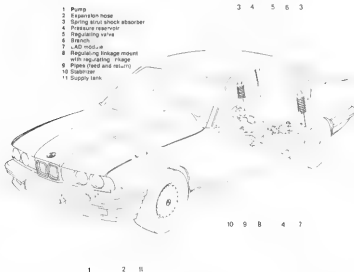
ADDITIONAL INFORMATION

Ride over the gnt control has the task of keeping the tail end of the car at a level as specified by gnt regulations of the payload up to max 1000 kg, load which is allowed, through which optimal handling is guaranteed

Refers to BMW "Technik" 37 02 01 115, for a precise description of ride level height control operation

Firing and bleeding hydraulic system are described in Group 33

LAYOUT DRAWING OF RIDE LEVEL CONTROL WITH LAD - CIRCULATING SYSTEM



37 10 610 ADJUST NO CAR RIDE LEVEL HEIGHT

Drive car on to a four pillar lifting platform and raise it just enough so that the ride wheels must bear on leveling blocks or moving plates.

Block the front wheels to prevent the car from spring back.

Move shift lever to neutral or selector lever to "N".

Release the parking brake lever.

Load down car by placing weights* in trunk at middle cross beam to passenger door position.

Start engine.

Disconnect pushrod from down on regulating valve.

Inspect it.

The lever on the regulating valve must not be disconnected.



If applicable, adjust wheel camber warning switch.

Note:

Located on rear ride camber at right-hand side.

- 1 Mounting screw
- 2 Rear ride cam
- 3 Linkage mounted to trailing arm
- 4 Regulating linkage
- 5 Wheel camber warning switch
- 6 Rear ride camber

Adjust car to ride level height. For warning switch by operating wheel on regulating valve measuring ride level height. Refer to Group 37.

Auto:

Lever moved forward	Car is lifted
Lever at center	No height change
Lever moved back	Car is lowered



Loosen screw 11.

Place screw 11 level on warning switch in position with a 4 mm dia pin (not too tight) to be holding tightly. If necessary tighten warning switch screw and remove holding pin.

Adjust car ride level height.

Load car by operating wheel on regulating valve lowering car.

* Refer to Specifications.

* Refer to Specifications.



Fig. 12-1

Lift car to ride level height* by operating lever on regulating valve forward (refer to Group 32 for information on measuring ride level height).

If the correct ride level height has been reached, move lever to center position and hold in this position with a shortened 3 or 4 mm dia. pin (and fig.).

Important:

Lever must not be operated beyond the center position in lowering direction. If this happens, repeat the adjusting procedure.

Both push rod on lever

Remove holding pin

Remove load from car and let it regulate down.

Load down car again, let it regulate up and check the ride level height.

If necessary, repeat the adjusting procedure.

* Refer to Specifications.

1)

37 12 10 REMOVING AND INSTALLING LEFT OR RIGHT REAR SPRING STRUT ASSEMBLY

Remove rear seat cushion and back rest - see Group 52.
Remove wheel - see Group 36.

Installation

Conform with filling and bleeding procedures on page 37 - 00(d) and check pipe connections for leaks.

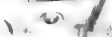
Unscrew pressure discharging plug (1) on the regulating valve and discharge the pressure.

Note

Place a span underneath.
Clamping screw on lever (2) must not be loosened!

J 23 7003 5

Remove rubber cover



Unscrew mounting bolts on spring strut.
Tightening torque**



J 23 7003 6

Remove dirt around the coupling nut (absolute cleanliness).
Unscrew coupling nut on pipe.

Installation

Tightening torque*

Lift out shock absorber from the side

Note

First screw nuts on the spring strut top for installation.
Lift the trailing arm and slide in the shock absorber from the side.

Support the trailing arm.
Unscrew mounting bolt.

Installation

Tighten bolt with car in normal position***
Tightening torque***

Keep dirt out of the connecting bore on the LAD module.

* See Specifications

** See Specifications of G1 32

*** See Specifications of G1 32

* See Specifications

37 12 210 REMOVING AND INSTALLING OR REPLACING RISE LEVEL REGULATING VALVE

Remove Manifold and line matters
see Group 18

Unscrew pressure discharging plug (1)
on the regulating valve and discharge
pressure

note

Place a pan underneath

Never open the clamping screw on
lever (2)

on manifold

Conform with filling and bleeding pro-
cedures and check pipe connections
for leaks

Adjust rise level height - see 37 12 0 10

**Unscrew regulating rod on the valve
lever**

on manifold

Tightening torque*

Unscrew pipes (1 - 3)

Unscrew mounting bolts and take off
the rise level regulating valve

on manifold

Tightening torque*

* See Special 015

37 14 066 CHECKING FUNCTION OF WHEEL CAMBER WARNING SWITCH (with BMW Service Tester)

Connect BMW Service Tester
Select instrument cluster check control
(00)
Select status: list of check controls
(200) and continue to page
wheel camber warning switch
Turn ignition on

Note
Refer to operating manual

Unscrew nut on transaxle (tilt linkage)

Adjustment
Tightening torque*

Move lever up
Display of Tester
Wheel camber incorrect

Move lever into middle position
Display of Tester
Wheel camber correct



Move lever down
Display of Tester

The wheel camber warning switch is
dryly. If the tester display is as
specified above while moving the lever

Note
Refer to test plan in case of a distur-
bance



37-14-513 REPLACING WHEEL CAMBER WARNING SWITCH

Pull off plug (1)
Unscrew nut (2) on transmitting
swage

Installation
Tightening torque*

Unscrew mounting screw (3)

Installation
Tightening torque*

Take off wheel camber warning switch

Installation
Engage new warning switch in console
of rear axle carrier and screw in the
mounting screw

Adjust car ride level height - see
37-13-010

37 31 005 CHECKING FUNCTION OF RIDE LEVEL CONTROL

Assemble Special Tool 32 4 000
Connect adapters on tester

Unscrew screws and take off the splash guard

Unscrew bolts

Insulation
Replace seals
Tightening torque*
Conform with filling and bleeding procedure on page 37-56/3
Check pipe connections for leaks

Connect tester

- 1 Pump connection
- 2 Connection for pipe to regulating valve

* See Specifications



A. Shut-off valve (low pressure)
0 to 10 bar or 0 to 21.3 psi

Important
Shut-off valve (A) must be closed for high pressure tests - pressure limiter would be damaged

B. Shut-off valve (high pressure)
0 to 150 bar or 0 to 2133 psi

Open valve B
Close valve A

Unscrew nut and disconnect regulating linkage on the stabilizer
Start engine

Regulating up position - lever moved forward
Max. 100% pressure*
Rear end of car lifted

Normal position - lever in middle position
Calculating pressure*

* See Specifications





Regulating down position = lever moved back.
Circulating pressure*
(Rear end of bar lowered)



37-21/230REPLACING LEFT OR RIGHT PRESSURE RESERVOIR

Unscrew pressure discharging plug (1) on the regulating valve and discharge the pressure

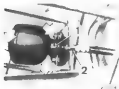
Note

Place a pan underneath.
Never loosen the clamping screw on lever (2)!

Installation

Confirm with filling and bleeding procedures on page 37-003.
Check pipe connections for leaks

37-21/2-1



Unscrew pipes (1 and 2)
Unscrew mounting bolts
Take off pressure reservoir

Installation

Replace rubber mounts if necessary
Tightening torque*



**37 21 500 CHECK NO. PRESSURE IN
37 21 501 LEFT RIGHT PRESSURE
RESERVOIR**

Assemble tester 37 4 006
Connect adapters on tester
Close valves (A and B).

Unscrew pressure discharging plug (1)
on the regulating valve and discharge
the pressure.

Note:
Place a pan underneath.

Installation:
Carry out with filling and bleeding pro-
cedures on page 37 000.
Check pipe connections for leaks.



Unscrew pipe (2) and connect tester to
check the left pressure reservoir.



Unscrew nut and disconnect regulat-
ing rod from the stabilizer.

Installation:
Tightening torque*



Start engine and regulate the system
upward (lever on regulating valve
moved forward).
Max. pressure* (ride level regulating
valve).
Stop engine.



Regulate the system downward (lever
on regulating valve moved back).
Min. pressure* (ride level regulating
valve).



Open shut-off valve (B) slowly and let
hydraulic oil run into the pan.
The pressure at which the pressure
gauge needle drops suddenly to 0, is
the gas charging pressure of the
pressure reservoir (shut off valve!).
Repeat test.

* See Specifications.

Remove tester
Connect pipe (2).

Installation
Tightening torque*



Checking Right Pressure Reservoir
If applicable, discharge pressure.
Unscrew pipe (1) and connect tester by
unscrewing bolt (3) and pushing the
cannon side.
Now perform the test in the same
manner as for the left pressure
reservoir.

Installation
Tightening torque*

* See Specifications

TROUBLESHOOTING RIDE LEVEL HEIGHT CONTROL WITH LAD (Load Dependent Absorption)

Condition	Cause	Correction
Measured car ride level height too high or too low	a) Ride level height not adjusted b) Regulating rod not mounted correctly	a) Adjust ride level height - refer to 37-12-010 b) Check regulating rod installation - repairing if necessary and adjust ride level height - refer to 37-12-010
Full load of car drops below nominal ride level height with payload and engine running	a) Car overloaded b) Hydraulic oil level too low c) Regulating rod not mounted correctly d) Feed pipe damaged e) Pump pressure too low f) Ride height regulating valve defective g) Spring strut shock absorbers defective	a) Check payload, reducing weight to maximum permissible axle load if necessary b) Check - correct hydraulic oil level c) Check regulating rod installation - repairing if necessary and adjust ride level height - refer to 37-12-010 d) Check feed pipe, repairing or replacing as necessary e) Check pump - refer to 37-21-005, repairing or replacing as necessary - refer to Group 32 f) Check ride level regulating valve - refer to 37-21-000/001 (Checking Pressure or Pressure Reservoir), repairing if necessary - refer to 37-12-010 g) Check spring strut shock absorbers (check absorber test), replacing if necessary - refer to 37-12-100

TROUBLESHOOTING RIDE LEVEL HEIGHT CONTROL WITH LAD (Load Dependent Absorption)

Condition	Cause	Correction
Rear end of car does not rise to normal ride level height when loaded	<p>a) Regulating rod not mounted correctly</p> <p>b) Feed return pipes damaged</p> <p>c) Ride level regulating valve defective</p> <p>d) Spring strut shock absorbers defective</p> <p>e) Pump pressure too low</p>	<p>a) Check regulating rod installation, repairing if necessary, and adjust ride level height - refer to 37-12-010</p> <p>b) Check feed return pipes, repairing or replacing as necessary</p> <p>c) Check ride level regulating valve - refer to 37-21-500-501 (Checking Pressure Oil Pressure Reservoirs), replacing if necessary - refer to 37-12-210</p> <p>d) Check spring strut shock absorbers (shock absorber test), replacing if necessary - refer to 37-12-100</p> <p>e) Check pump - refer to 37-21-005, repairing or replacing as necessary - refer to Group 30</p>
Leaks between pressure reservoirs and LAD module damaged	<p>a) Ride level regulating valve defective</p> <p>b) Gas charging pressure valve in pressure reservoir</p>	<p>a) Check ride level regulating valve - refer to 37-21-500-501 (Checking Pressure Oil Pressure Reservoirs), replacing if necessary - refer to 37-12-210</p> <p>b) Check pressure reservoir - refer to 37-21-500-501 (Checking Pressure Oil Pressure Reservoirs), replacing if necessary - refer to 37-21-030</p>
Car suspension harder than normal	<p>a) LAD module defective</p> <p>b) Gas charging pressure loss in pressure reservoir</p>	<p>a) Check LAD module, shock absorber (shock absorber test), replacing as necessary - refer to 37-12-100</p> <p>b) Check pressure reservoir - refer to 37-21-500-501 (Checking Pressure Oil Pressure Reservoirs), replacing if necessary - refer to 37-21-030</p>
Weak shock absorbers, knocks from rear axle	<p>a) Spring strut shock absorbers defective</p>	<p>a) Check spring strut shock absorbers (shock absorber test), replacing if necessary - refer to 37-12-100</p>

TROUBLESHOOTING RIDE LEVEL HEIGHT CONTROL WITH LAD (Load Dependent Absorption)

Condition	Cause	Correction
Permanent display of wheel camber warning switch Instruments Cluster display: ride level height control	a. Car overloaded	a) Check payload, reducing weight to maximum permissible axle load if necessary
	b. Hydraulics oil level too low	b) Check, correct hydraulic oil level
	c. Regulating rod not mounted correctly	c) Check regulating rod installation, repairing if necessary and adjust ride level height - refer to 37 12 010
	d. Feed pipe damaged	d) Check feed pipe, repairing or replacing as necessary
	e. Pump pressure too low	e) Check pump - refer to 37 31 000, repairing or replacing as necessary - refer to Group 38
	f. Ride level regulating valve defective	f) Check ride level regulating valve - refer to 37 31 000/301 (Checking Pressure of Pressure Reservoirs), replacing if necessary - refer to 37 12 010
	g. Adjustment of display of wheel camber warning switch incorrect	g) Check adjustment, adjust wheel camber warning switch if necessary - refer to 37 13 010 (adjusting ride level height)
	h. Fuse 65 (5) blown	h) Check circuit, troubleshoot electrical systems, replace fuse
	i. Wheel camber warning switch defective	i) Check wheel camber warning switch - refer to 37 14 000, repairing if necessary - refer to 37 14 010

41 Body

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300 Cover for left or right side member with door pillar (partial replacement A and B pillars) - replace	41-	11/5
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41 14 151 Wheel house outer section and side panel, rear, left - replace	41-	14/1
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503 Wheel house outer section, rear, right - replace (side panel removed)	41-	14/53
41 31 001 Roof panel - replace (version without double sunroof)	41-	31/50
011 Roof panel - replace (version with double sunroof)	41-	31/53
41 33 001 Front panel complete with front wall - replace	41-	33/1
41 34 041 Tail panel - replace	41-	34/1
041 Tail panel - replace	41-	34/50
41 35 000 Side panel, front, left or right	41-	35/1
105/115 Side panel, rear, left or right - replace (partial replacement C-pillar)	41-	35/1.1
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41 52 080 Rear door, left or right - remove and install	41-	51/2
41 61 000 Engine hood - remove and install	41-	61/1
014 Engine hood - adjust	41-	61/2
545 Engine hood hinge - remove and install or replace (engine hood removed)	41-	61/4
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INTRODUCTION

This repair manual for body jobs is supplied for skilled workers and consequently it is assumed that persons referring to this manual will be well qualified, conscientious workers with the necessary amount of responsibility.

Instructions are therefore limited to information on factory approved repair methods as well as related tips and working aids.

The described body repair also refers to the complete or partial replacement of parts with original BMW replacement parts or sections of replacement parts. Straightening and dent removal must be adapted to a pertinent damage scope. Concerned welding and spot welding seams must be inspected and if necessary repaired.

Refer to the cut out parts for the quantity and location of welding spots, inert gas welded seams and brazed connections. Use inert gas plug welding instead of spot welding in non-accessible areas.

Mask pictures show a rough, unpainted bodywork. Remove or cover all car parts which are in the repair zone and are in danger of being subjected to heat, sparks or dust.

Disconnect the ground lead on the battery or body connect on point. Protect electrical leads against dangers of mechanical or thermal influence.

Conform with safety precautions for cars with SRS.

Conform with fire and accident prevention regulations.

Welding can be performed after removal of control units, if

there is a guarantee of about 1 meter (3 feet) distance between welding and ground connections and

there is a guarantee of good electric connection between welding and ground points, no rubber mounts or anything similar.

If not, thermal development must be considered especially in case of autogen welding (guided arcs). Must be made for each individual case.

In spite of continuous quality control in welding by the factory, it is as if possible that some welded joints could be faulty. They will be repaired in the factory automatically, either with inert gas spot welding or when not accessible, with 15 mm (0.590") long inert gas welded seams on the flange and consequently repaired welded seams on the body do not always find their repair by a third party.

For example: left engine carrier member resistance spot welded, right engine carrier member welding repaired with inert gas welding.

Important:

The steering gear must be inspected and maybe repaired after an accident or accident-like driving conditions. (see Service Information 32-01-88 (326).

Seal all welding seams, which had been sealed or galled with a body sealing compound, correctly and immediately after repairing. Replace damaged anti-drumming insulation.

Seal new sheet metal parts or the car body seams, creases and folds produced by new sheet metal parts with a body sealing compound immediately.

Source of supply for workshop equipment, aids, sealing materials, cements and similar products: HVB, a Business Division of BMW AG.

REMOVING PVC MATERIAL IN REPAIR ZONE

Corrosion inhibition after repainting begins already with the professional removal of PVC undercoating, anti-drumming compound and seam-sealing compound in the repair zone.

Remove PVC material with a rotating steel brush or heat PVC to maximum 180 °C (355 °F) with a hot air blower and scrape off with a spatula.
 Burning off the PVC material or heating it above 180 °C (355 °F) with a gas flame torch or similar tool would produce strong cones of poisonous hydrochloric acid.
 Health-threatening vapours would also be set free.
 New undercoating would not have sufficient adhesion on burnt PVC material and cones of highly undercoating rusting would be possible.

WELDING GALVANIZED SHEET METAL

Hot galvanized and galvanized sheet metal is used to a greater extent for components of the body, which are especially subject to corrosion.

Compliance with the following points is necessary when working with these parts.
 The welding smoke contains poisonous zinc oxide, so that especially good extraction is necessary in the welding bay.
 Do not grind off zinc coat for resistance spot welding and inert gas welding.
 The zinc coat, however, must be ground off for brazing jobs.

If at all possible, welded connections should be made with resistance spot welding.
 Welding current is boosted by at least 10 % as compared with blank sheet metal. Apply as high as possible electrode contact force (make break-out test on sample sheet metal). A coat of spot welding paste can be applied for better sealing.

Inert gas welding should be preferred to autogen welding in areas not accessible for resistance spot welding, because of the lower heat dispersion.

Mechanical forming of galvanized sheet metal in warm state is normal.

Make sure of thorough extraction of poisonous vapours.

Remove burnt residual zinc completely.

Align, grind down and run out visible joints as normally.

RECOMMENDED WORKING METHODS AND TOOLS

1 Cutting Out Damaged Parts

Determine the location of mating surfaces with help of the replacement part before beginning with the work. Cut out damaged part roughly within the mating surfaces.

Caution:
Don't damage sheet metal located underneath.

Remove sealing compound, anti-drumming compound and, if applicable, paint to neutralize the connection points. Drill out spot welding. Make sure holes are drilled in the cut out part while drilling. Don't drill in the corners or flanges remaining for installation of the new part.

Grind off welded seams with a disc grinder carefully. Heat brazed connectors with an acetylen gas torch (don't heat excessively). Lift off scrap metal. Remove residual brazing solder with a steel brush. Straighten and grind all connection points thoroughly.

2 Installing New Parts

Prepare connection points to pertinent repairing instructions.

Always perform repairs, which concern the suspension points of the engine, transmission, axles or running gear, on a straightening bench with the attachments belonging to the car type. There are also attachments for different body parts. Check curvature and dimensions of windshield and rear window by replacing an original window. Refer to part name drawings for the gaps of doors, engine hood and trunk lid.

Coat mating surfaces intended for resistance spot welding with zinc dust paint. Only remove the protective paint from galvanized replacement parts. Drill 3 mm (0.315") dia. holes with same spacing as the drilled out welded spots. In connections not accessible for the spot welding torch and inert gas plug weld.

Produce inert gas welded seams according to the part cut out.

Produce brazed connections with as little as possible heat dispersion and without excessive heat. Procedures deviating from standard connections will be described in the repair manual. Grind down welded seams visible on outside surfaces.

Caution:
Don't grind down the sheet metal too thin.

Straighten and fix all irregularities. Finishing out is supposed to prepare the surface to such an extent that only a coat of fine primer has to be applied prior to spraying on paint.

Seal off all welding seams, which had been sealed in original state with a body sealing compound, correctly and mixed slowly after repairing. Replace damaged anti-drumming compound. See new sheet metal parts or the cavities, seams, creases and folds produced by new sheet metal parts with a body cavity sealing compound immediately.

SAFETY PRECAUTIONS FOR WORKING ON BODY OF CARS WITH AIRBAG

Disconnect both poles of car's battery before working with an electric welder.
Cover battery poles.

Parts of the airbag system must not be subjected to heat greater than 100°C (210°F) for even briefly.

If there is danger that working on the body could subject parts of the airbag system to strong vibrations, they should be removed as a precautionary measure.

In case of deformations or when installing the holders for both crash sensors on the front wheel houses on left and right sides, make sure that the holders are aligned parallel to the car's longitudinal axis precisely.

Also refer to the repairing and safety regulations concerning the airbag system in Group 32.

Disconnect plugs of both front sensors (C)



Unscrew lower casing section.
Pull out plug-out of holder and disconnect.

21 52 674



Components

- a Airbag housing wheel with impact shell and impact pad, in which airbag, gas generator and ignition pill are integrated
- b Contact ring - guarantees power supply to the ignition pill
- c Two crash sensors (left and right front on wheel houses) and safety switch left
- d Electronic diagnosis unit - instrument panel area left with integrated set up sensor (drivetrain, steering, acceleration)
- e Airbag indicator lamp integrated in check control unit

Frame alignment control dimensions, BMW 5 Series E34 Sedan

Sheet 1

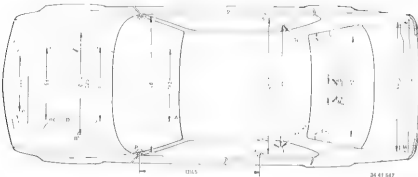
Dimensions in mm, tolerance: ± 0 mm

Differing dimensions for 4WD in brackets

Note

Only use the following values for a rough inspection

Repairs can only be carried out correctly with the approved set of attachments and a straightening bench



- A = Base in rear engine center
- B = Front spring mount
- C = Front axle take-up
- D = Front axle support
- E = Rear axle take-up at a de
- F = Spring mount, rear
- G = Ridge as a front lower
- H = Ridge axle front upper

- I = Ridge axle rear lower
- K = Ridge axle rear upper
- L = Base front crossmember
- M = Base crossmember rear
- N = Rear axle support, center
- P = Front car jack take-up
- Q = Rear car jack take-up

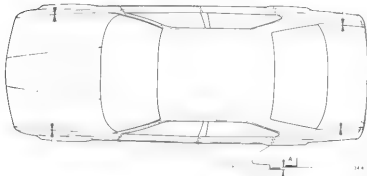
34 41 547

GAPS OF DOORS, ENGINE HOOD, TRUNK LID

Door and hood/lid gaps: 5.5 ± 0.5 - 10 mm (0.216 - 0.393")

Permissible deviation in parallel: 1 mm (0.040")

Plane displacement A for each body part adjacent to the rear =
max. 1 mm (0.040") toward inside



WINDOW AND DOOR GAPS OF FRONT AND REAR DOORS

All dimensions in mm



Schnitt B-B

a	23
b	9
c	10



Schnitt C-C

a	12
b	9
c	10



Schnitt A-A

a	12
b	9
c	10



Schnitt D-D

a	12
b	9
c	10



Schnitt A-A

a	23
b	9
c	10



Schnitt C-C

a	12
b	9
c	10



Schnitt A-A

a	12
b	9
c	10



Schnitt F-F

a	12
b	9
c	10



DIE STAMPING VEHICLE IDENTIFICATION NUMBER

The chassis number must be die stamped again if it had been removed during body repairs.

Note:

The chassis number can also be die stamped in a completely assembled car, but then the coolant reservoir cover on separating-wall windshield wiper arms and on inlet grille must be removed.

Assemble Special Tool 41-1-001 in such a manner that smooth side of the baseplate faces the stamp guide.

Screw in bolts only far enough that the spacing in baseplate can be installed later.



Place impact numbers 41-1-002 in special tool separately and die stamp the chassis number. Die stamp "V" in front of the chassis number (unless) of the BMW emblem to indicate replacement of parts or body in a workshop.



Install and clamp Special Tool 41-1-003 on left and right sides.

Place special tool fixture base on concerned surface.

Align baseplate to be parallel with the stamp guide with bolt (1).

Align special tool fixture.

Tighten bolts (2).



COMPLETING REPLACEMENT PART ENGINE CARRIER MEMBER WITH WHEEL HOUSE OR FRONT WHEEL HOUSE

*In order during repair, wheel houses are supplied without the brackets of fitting according to vehicle type.

Brackets can be used from the cut out part or ordered new separately.



Grind down wheel house only on points used for plug spot welding, so that marks remain. No points on the bracket are not removed.



Positions of brackets are marked on the wheel house.



Grind down the plug spot welding when using new brackets.

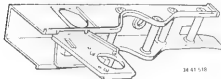


Hold brackets on permanent marks.
Draw holes.

41 11 043: REPLACING LEFT OR RIGHT ENGINE CARRIER FRONT SECTION 41 11 044: (Without Wheel Hub(s))

Procedures are described for the left side of the car.
Procedures are analogous for the right side of the car.

Refer to Introduction on page 41 - 0.1



Remove or disconnect/detach the following parts:

Left Side of Car

- Ground connection on ground pole of battery or body ground point
- Front axle with engine and transmission, fuel and brake pipes/hoses as required
- Hydraulic control unit
- Brake booster with hoses
- Cooling coil for power steering
- Cover for radiator
- Carbon canister
- Heater valve and positive pole connection point
- As electric heater in front panel
- Wiper arms and grills
- Front bumper
- Radiator grill, turn signals and headlights
- Engine hood with lock and cable
- Horn
- Frontal air assembly
- Front cross member
- Pedal base assembly complete with steering column
- Heater and air conditioner
- Both front seats (complete)
- Front carpets (complete)
- Insulation sheets

Right Side of Car

- Additional heat protect on sheet on engine compartment wall
- Windshield washing fluid tank and air cleaner

REPLACING FRONT ENGINE CARRIER SECTION

Note

Most of the spot welded points on the engine carrier will not be accessible with spot welders common in workshops.

Produce holes while drilling all spot welds in such a manner, that they can be used for plug spot welding later.



34 11 100

Drill off spot welds on inside and bottom.



Drill all rows of spot welds from the passenger compartment.



34 11 100

Drill off only the indicated spot welds on the outside.



34 11 100

Drill off connections on the cross member.

Take up engine carrier and cross member on a straightening bench for welding.



34 11 100

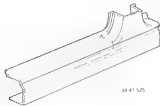
Installation

Crimp the spot welding flange in cone C (= 30 mm / 1 3/16") toward inside by an angle of approx. 30° to guarantee clearance of wheel when the steering wheel is turned against lock.

D clearance D is approx. 25 mm (1").
Zone E (on left and right sides) approx. 40 mm (1 5/8").

41-11-250 REPLACING COVER FOR LEFT OR RIGHT FRONT SIDE MEMBER (PARTIAL REPLACEMENT A AND B PILLARS)

Refer to "Introduction" on page 41 - 0-1



Remove or disconnect/detach the following parts:

- Ground pole on battery
- Front and rear doors
- Front and rear covers (on outside of entrance)
- Trim panel for B pillar
- Seat belt
- Front seat
- Rear seat cushion
- Front and rear plates (on inside of entrance)
- Edge guard
- Radio loudspeaker cover
- Wire harness (A pillar)
- Front and rear carpets (partially)
- Pipe installations



1.1

Draw cutting lines according to size of the replacement part

Along

A vertical running reinforcement plate is located in front of hole (1) - provide sufficient distance

Connection (2) is brazed in the corner



1.2

Plug weld connection (1) with the reinforcement plates

Produce the connection at joint (2) in the same manner as the original connection



1.3

2.1 to

The B-pillar has double panel walls

The inner panel must not be damaged while cutting off



2.2

Cut out old section

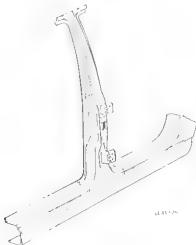


2.3

Produce new weld in reinforcement plates having a width of about 40 mm (1 1/2 in.)

41-11-308 REPLACING COVER FOR LEFT OR RIGHT SIDE MEMBER WITH CENTER DOOR PILLAR (PARTIAL REPLACEMENT A AND B PILLARS)

Refer to INTRODUCTION on page 41-11-1



Remove or disconnect/detach the following parts:

Ground pole on battery

Front and rear doors

Front and rear covers (on outside on entrance)

- Trim panel for B-pillar

Seat belt

Front seat

Rear seat cushion and backrest

Front and rear covers (on inside of entrance)

Edge guard

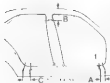
- Radio/speaker cover

Wipe harness (A p. 14)

Front and rear carpets (partial g)

Pipe installations

Roof rack

**Door cutting lines**

Distance A = to replacement part size

Distance B = 170 ± 20 mm

(6.693 ± 0.787")

Distance C = at least 50 mm (2")

Notes

A vertical running reinforcement plate is located in front of hole (*) - provide sufficient clearance

Keep cutting line (C) out of the bend whenever possible (- paint) (note)

**B-pillar reinforcement plates**

A: Inside plate

B: Outside plate



Align the replacement section with the doors

**Cut out old section**

Seal off the end plate on the B-pillar with a joint sealing compound before welding in the replacement section



Produce and weld in reinforcement plates having a width of about 40 mm (1.575")

41-11 REPLACING FRONT CROSS MEMBER

Refer to "Introduction" on page 41-0-1

This repair will normally occur together with work on the engine carrier members.

Remove or cover all car parts which are in the repair zone and subject to damage from heat, sparks or dust.

Set up car on a straightening bench insert cross member.

Important!

Check location of member. The end of the member could be inserted forward

Check for perfect spot welding

Steel Metal Thickness

Engine carrier 1.2 mm (0.047")

Cross member 0.8 mm (0.031")



41-14/1

41 14 151 REPLACING LEFT REAR WHEEL HOUSE OUTER SECTION AND SIDE PANEL

Procedures are described for the left side of the car.
Procedures are analogous for the right side of the car.

Refer to "Introduction" on page 41 - 2 1



55 41 527

Remove or disconnect/detach the following parts:

Side panel (see 41 35 155)

Fuel tank (complete with expansion tank)

Wiring harness on C-pillar



Punch cut in the middle of the rear window frame (C-pillar) wherever possible

Note:
Note initial position of the antenna amplifier trap circuit



Produce a reinforcement plate having a width of about 40 mm (1 5/8")

Note:
Mount the reinforcement plate on the outside of the rear window frame
↑ - Installed direction of antenna amplifier trap circuit



Drill off spot welds in wheel house



Fit in the rear window frame (C-pillar)

Note:
Produce connections in the same manner as the original connections



Drill off spot welds on the inside side member panel
Bend open the inside panel and drill off the spot welds underneath



Seal off the end plate with a joint sealing compound before welding in the slide panel



Straighten the inside side member panel and insert the outer wheel house section

Note:
Produce connections in the same manner as the original connections



41 14

REPLACING RIGHT REAR WHEEL HOUSE, R.H.P. SFC TWIN (Side Panel and Wheel House Outer Section Removed)

Timing

Refer to "Introduction" on page 41 0 1

Remove or disconnect the following parts:

Same steps of work as for the right rear
wheel house outer sectionRemove or cover all other car parts, which
are in the repair zone and subject to be
damaged from heat, sparks or dustBreak the welding seams for the seat belt
holder take-upBreak the welding seams for the seat belt
holder take-up
Remove the seat belt holder

Uncover the left top wheel house joint

Drill off welding spots



Uncover the rear top wheel house joint

Drill off welding spots



Uncover the inside wheel house bottom side member, wheel house extension and spring support joints.

Drill off welding spots.



Remove the wheel house inner section. Remove scrap metal. Straighten and grind the mating surfaces.



Install and clamp the wheel house inner section with air cylinder. Mark the mating surfaces. Mark the location of holes for plug welding.



Remove the wheel house inner section. Clean the mating surfaces. Drill holes for plug welding. Coat the mating surfaces with zinc dust paint.



Install and clamp the wheel house inner section with the aid of attachments and spot weld.



Plug weld the wheel house extension side member at front top and wheel house inner section.



Weld the wheel house joint at top front.

Grind down the welding spots.



Weld the wheel house joint at top rear.

Grind down the welding spots.



Clamp and weld the take-up for the seat



Weld the seat belt holder take-up

Grind down the welded surfaces



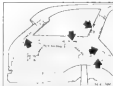
41-14 533 REPLACE RIGHT REAR WHEEL HOUSE OUTER SECTION (Side Panel Removed)

Touring

Refer to "Information" on page 41-0.

Remove or disconnect the following parts:
Seat belt restraint covers
Battery
Right trunk floor plate with harness

Remove or cover all other car parts which are in the repair zone and subject to be damaged from heat, sparks or dust.



Drill off welding spots on wheel house and support member.
Drill off welding spots on C pillar support member extension.



Break the welding spots on the wheel house at top.
Remove the support member together with the support member extension.



Remove and drill off welding spots on the wheel house outer section.

Important:
The wheel house inner section, wheel house outer section and side member are welded together in area (1).

Remove the wheel house outer section.
Remove scrap metal.
Straighten and grind the mating surfaces.



Install and clamp the wheel house outer section. Mark the welding surfaces and remove the wheel house outer section again.
Clean and coat the welding surfaces with zinc dust paint.

Important

The wheel house outer section, wheel house outer section and side member are welded together in area (1). Drill corresponding plug welding holes in the connecting parts.



Weld the wheel house outer section.

Important

The wheel house outer section, wheel house outer section and side member are welded together in area (1). Plug welding must connect connecting parts together.

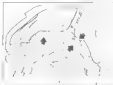
Grind the welded surfaces.



Install and clamp the wheel house outer section.
Install and clamp the side panel.



Align the side panel and wheel house outer section with the adjacent body parts. Remove the side panel again.



Clamp Support Member

Clean and coat mating surfaces on the wheel house outer section with zinc dust paint.



Clean and coat mating surfaces on the support member with zinc dust paint.



Fit in and spot weld the support member

Grind the welded surfaces



Fit in and clamp the support member attachment

Align the mating surfaces and remove the support member extension again
Clean the mating surfaces with disc dust point



Drill plug welding holes in the support member extension in areas (1 and 2)

Clean area (3) for spot welding

Coat the mating surfaces with disc dust point



Fit in and weld the support member attachment

Plug weld in areas (1 and 2)

Spot weld in area (3)

Grind the welded surfaces



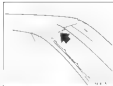
41 31 001 REPLACING ROOF PANEL (Version without Double Side Roof)

Tooling

Refer to "Information" on page 41-01

Remove or disconnect the following parts:
Windshield
Roof liner
Rear seat cushion
Battery ground lead
All rain molding strips and channels
Both rear side windows
Both front seats
Tailgate seat
Both rear seat headrests
Front and rear roof liner wires

Remove or cover all other car parts, which are in the repair zone and subject to be damaged from heat, sparks or dust



Uncover the B-pillar joint



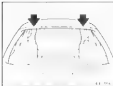
Uncover the B-pillar joint



Cut through the rear roof frame roughly in front of the joints



Cut through the side roof frames roughly in front of the joints



Cut through the front roof frame roughly in front of the joints.



Remove the roof panel.

Important:
The roof panel may be heated at the surfaces coated with sealing compound to make removal of the roof panel easier. Extract the caused vapors!



Remove scrap metal to straighten and give the mating surfaces. Remove sealing compound.



Fit in new roof panel and press the mating surfaces. Coat the mating surfaces with zinc dust paint.



Coat the roof frame with sealing compound.



Install and clamp the roof panel.



Spot weld the roof panel along the slots.



Spot weld the windshield frame.



Spot weld the taillight frame



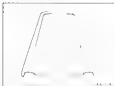
Brake the A-pillar mating surface 1/8 in. out and grind the surface



Brake the C-pillar mating surface 1/8 in. out and grind the surface



Brake the taillight frame at top
Grind the braced surfaces
Grind the welded surfaces



41-31-011 REPLACING ROOF PANEL (Version with Double Sun Roof)

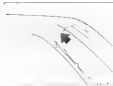
Warning:

Refer to "Information" on page 41-0-1

Remove or disconnect the following parts:

- Sunroof and
- Side sun roof
- Rear seat cushion
- Battery ground lead
- All rain draining strips and channels
- Both rear side windows
- Both front seats
- Front seat
- Both rear seat backrests
- Front and rear roof liner wires
- Roof liner

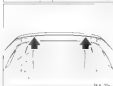
Remove or cover all other car parts, which are in the repair zone and subject to be damaged from heat, sparks or dust.



Unbolled the D-pillar joints



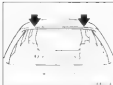
Unbolled the A-pillar joints



Cut through the rear roof frame roughly in front of the joints



Cut through the side roof frame roughly in front of the joints



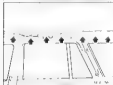
Cut through the front roof frame roughly in front of the joints



Grind the front roof panel mating surfaces on the roof frame

Note:

The picture is a view of the right roof frame as seen from inside of the car



Grind the center roof panel mating surfaces on the roof frame

Note:

The picture is a view of the right roof frame as seen from inside of the car



Grind the rear roof panel mating surfaces on the roof frame

Note:

The picture is a view of the right roof frame as seen from inside of the car



Remove the roof panel

Important!

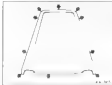
The roof panel may be heated at the curbs (as coated with sealing compound) to make removal of the roof panel easier.
If even the caused vapors!



Remove scrap metal

(straighten and grind the mating surfaces)

Remove sealing compound



Fit in new roof panel and close the mating surfaces

Coat the mating surfaces with zinc dust paint



Coat the roof frame with sealing compound



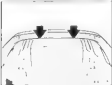
Install and clamp the roof panel.



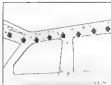
Spot weld the roof panel along the sides.



Spot weld the windshield frame.



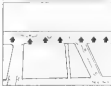
Spot weld the tailgate frame.



Weld the roof panel on the front roof frame.

Note:

The picture is a view of the right roof frame as seen from inside of the car.



Weld the roof panel on the center roof frame.

Note:

The picture is a view of the right roof frame as seen from inside of the car.



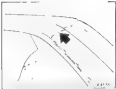
Weld the roof panel on the rear roof frame.

Note:

The picture is a view of the right roof frame as seen from inside of the car.



Grind the A-pillar mating surfaces. Grind out and grind the surfaces.



Grind the B-point mating surface, 1/4 in out
and grind the surface



Grind the top edge from 1/4 in
Grind the mated surfaces
Grind the welded surfaces

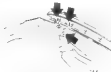
41-33-001 REPLACING FRONT PANEL COMPLETE WITH FRONT RAIL.

Note: Information on 41-33-1

Front panel can be removed and installed without removal of side panels.

The following parts must be removed as illustrated:

Ground lead on battery splash guard, front bumper assembly, oil separator (oil separator with double headlights with turn signals and electric leads are cleaned with a 1/8" flow passage, weighing fluid tank, resistor complete with contact paper, lamp cover and bracket, cooling fan on power steering, both horns, wire harness in front wall, engine hood, engine hood lock and hinge covers for engine hood.



Unscrew left and right bolts.
Cut through sealing compound.

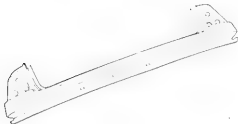


Unscrew bolts.
Lift off front panel.

41-34/1

41-34/041 REPLACING TAIL PANEL

Refer to "Introduction" on page 41-0-1



Remove or disconnect/detach the following parts:

Ground lead on battery

Rear bumper assembly

Both bumper brackets complete with impact absorbers

Trunk lid rubber seal

Trunk trim panels

Left and right spare air extractors

Tank flap drive motor

Both tail light assemblies with electric leads

Both electric lead covers on trunk floor

Spare wheel

- Trunk lid lock cover section
- Fuel tank complete with expansion tank

REPLACE RIG TAIL PANEL

The tail panel replacement single consists of the tail panel with spot welded shear plate for tie tight assemblies.

A complete tail panel can only be installed after removal of one side panel.

Procedures with Installed Side Panels

Drill out welded spots on the connection between the tail panel and tie tight shear plate on all the shear.

First, install the tail panel with the temporary shear.

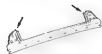
Check arrangement of overlapped shear plates.

The wedge connector on the tie for the attachment is located above the tail panel.

Install the cut out shell first.

Check arrangement of overlapped shear plates.

When making, make sure that the gap between the trunk floor plate and tie panel is filled out completely on the inside and outside.



34-34-100



34-34-101



34-34-102



34-34-103



34-34-104



34-34-105



34-34-106

41-34/50 REPLACING TAIL PANEL

Taunting



Fig. 41-34/50

Refer to "Information" on page 41-3-1

Remove or disconnect the following parts:
 Battery ground lead
 Rear bumper and brackets
 Bumper lead
 Both tail light assemblies
 Luggage compartment liner
 Fuel tank
 Spare wheel
 Driftail trim panels
 Washing fluid tank for tailgate window

Remove or cover all other car parts, which are in the repair zone and subject to be damaged from heat, sparks or dust



Fig. 41-34/51

Cut out the tail panel roughly in front of the joints in the luggage compartment to the right



Fig. 41-34/52

Cut out the tail panel roughly in front of the joints in the luggage compartment to the left



Fig. 41-34/53

Cut out the tail panel roughly in front of the D-pillar joint



Fig. 41-34/54

Cut out the tail panel roughly in front of the side panel joint

Remove scrap metal.
Straighten and grind the mating surfaces.

Fit in and clamp the tail panel from inside of the car.



Clean the tail panel luggage compartment floor plate mating surfaces and drill holes for plug welding.

Weld the tail panel to the side panel mating surface.



41-34/51-2



Clean the tail panel spare wheel well mating surfaces and drill holes for plug welding.

Weld the tail panel to the mating surfaces in the luggage compartment to the right.



41-34/51-4



41-34/51-5

Coat the mating surfaces with zinc dust paint.

Weld the tail panel to the mating surfaces in the luggage compartment to the left.



41-34/51-6



1. Grind the light bulb holder G-polar mating surface
2. Grind the mating surfaces

41-35/1

41 35 000- REMOVING AND INSTALLING OR REPLACING LEFT OR RIGHT FRONT SIDE PANEL

Refer to information on 41-35-1

Remove or disconnect the following parts:

Front bumper with side bracket, both windshield wiper arms, heavy for left side panels, heater air grill, rubber seal between side panel and cruise wheel trim. Transfer rubbing strip on side panel.



UnscREW screws



Warn:
Be careful not to damage the paint for when the door is installed.



UnscREW screws



UnscREW screw AB



UnscREW screws



Lift off side panel



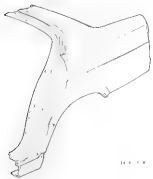
Position:
Align side panel with the door gap and engine hood

41-35/1.1

41 35 100- REPLACING LEFT RIGHT REAR SIDE PANEL 41 35 115 (PARTIAL REPLACEMENT (C PILLAR))

Procedures are described for the left side of the car
Procedures are analogous for the right side of the car

Refer to "Introduction" on page 41 - 0-1



41 35 100

Remove or disconnect/detach the following parts

Left Side

- Ground lead on battery or body ground point
- Trunk lid, rubber seal (trunk lid), trunk lid wire harness (partially)
- All trunk trim panels, car jack, wheel wrench, spare wheel
- Bumper assembly
- Tail light assembly
- Spare air extraction cover
- Complete rear seat cushion, seat belt lock
- Mats
- Roof liner
- Rear window
- Cover and carpet on entrance
- Wire harness (partially)
- Running strip (side panel), plate (C-pillar), rear holding strip
- Rear wheel and wheel house panels

Right Side (Additionally)

- Tank flap
- Fuel tank complete with expansion tank
- Central lock (park flap)

41-35/1.2



Locate cutting line (1) as close as possible to the middle of the Coplar linerover brazed seam (2) when a cutting line is required close to the rear joint and locate the cutting line (2) about 50 mm (2") below the brazed seam.



Locate cutting line (2) about 50 mm (2") below the brazed seam.



SA 41-35/1.2

Bend down the cringed-up spot welding flange in the area of the wheel opening.

Installation

Cringe the spot welding flange in zone B = 305 mm (12 785") toward the interior by an angle of 60°. Zone A = 50 mm (2"). Distance C = 20 mm (0 787").



SA 41-35/1.2

Produce reinforcement plates having a width of about 40 mm (1 5 7") and weld them in at pertinent points.



SA 41-35/1.2



SA 41-35/1.2

Brazing the front trunk point (connection with the rear window).



SA 41-35/1.2

Check arrangement of overlapped sheet metal on the left panel when installing the side panel.

41-3572

41 35 337 REPLACING LEFT/RIGHT REAR SIDE PANEL
41 35 338 (PARTIAL REPLACEMENT UP TO WHEEL HOUSE)

Procedures are described for the left side of the car.
Procedures are analogous for the right side of the car.

Refer to "Introduction" on page 41.

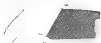


Remove or disconnect data to the following parts:

- Ground seed on battery
- Rear bumper assembly
- Side bumper bracket
- Rubber seal for trunk lid
- Trunk seal
- Trunk trim panels
- State air extractor plate
- Wheel house panel
- Tail light assembly
- Tail pane
- Wire harness (part only)

Additionally for Flight Date Period

- Tank flap
- Complete fuel tank
- Expansion tank
- Control logic for tank flap



24-17-1

SECTION REPAIR ON REAR SIDE PANEL

The panel section is cut out of a complete rear side panel in the factory.
Location of cut - also refer to plan for side rib sections.

Important
Locate the cut as far away from the rear window as possible.

Whenever possible, the original connection should be used for connection with the trunk opening at the front.

Cut connection is sure slipping 10 mm (0.394") for overlapping and shoulder with a shouldering plate.

Check arrangement of overlapped sheet metal on tail panel when installing the side panel.

Spot weld the joint until a continuous seam is produced.



24-17-2

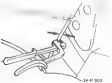
24-17-3



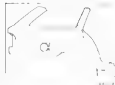
24-17-4



24-17-5



24-17-6



41-35-115 REPLACE RIGHT REAR SIDE PANEL (Circuit Panel Replacement)

Touring

Refer to "Information" on page 41-G-1

Remove or disconnect the following parts:
 Battery ground lead
 Rear bumper
 Right rear side window
 Tail light assembly
 Rocker
 Top hinge
 Rubbing strip on side panel
 Right rear seat belt
 Luggage compartment interior
 Strip on right rear channel
 Tailgate gas pressure struts

Important!
 Support the tailgate.

Remove or cover all other car parts, which are in the repair zone and subject to be damaged from heat, sparks or dust.



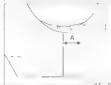
Determine, mark and cut the C pillar along the cutting line.

Distance A = 40 mm



Determine, mark and cut the B pillar along the cutting line.

Distance A = 300 mm



Determine, mark and cut the side member entrance along the cutting line.

Distance A = 70 mm



Grind on the welding spots in the door opening.



Uncover and drill off side window mating surface welding spots.



Drill off welding spots of bracket (1) and remove the bracket.



Unbent edge of the wheel house



Uncover and drill off welding spots on wheel house and wheel house extension



Cut off side panel roughly in front of the mating surfaces.
Remove the side panel

Remove scrap metal
Straighten and grind the mating surfaces



Prepare 110 mm and coat a reinforcement plate for the D-gitter with steel mesh plate

Width = 60 mm



Drill holes in the D-gitter for plug welding
Coat the mating surface with zinc dust
Grind
Insert and weld the reinforcement plate (30 mm)
Grind the welded surface



Produce, fit in and coat a reinforcement plate for the C-pillar with zinc dust paint.
Width = 50 mm.



Drill holes in the C-pillar for plug welding.
Coat the mating surface with zinc dust paint.
Insert and weld the reinforcement plate 30 mm.
Grind the welded surface.



Produce, fit in and coat a reinforcement plate for the side member entrance with zinc dust paint.
Width = 50 mm.



Drill holes in the side member entrance for plug welding.
Coat the mating surface with zinc dust paint.
Insert and weld the reinforcement plate 30 mm.
Grind the welded surface.



Cut the side panel to size and fit in.
Drill holes for plug welding.



Apply sealing material* around the opening for the front filler neck.



Install and clamp the side panel.
Align the side panel to the left side.



Align the side panel to the rear door and side member.

* Source of Supply: Stahl Parts



Spot weld the side panel in the area of the door opening



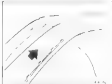
Spot weld the side panel in the area of the side window



Spot weld the side panel in the area of the fenders



Grind the right built-in door-D-pillar mating surface



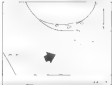
Plug weld the reinforcement plate at the D-pillar mating surface
Afterwards produce single welding spots so close together that a continuous seam is produced

Important!
Always let the one welding spot cool off slightly before producing the adjacent one
Danger of distortion!



Plug weld the reinforcement plate at the C-pillar mating surface
Afterwards produce single welding spots so close together that a continuous seam is produced

Important!
Always let the one welding spot cool off slightly before producing the adjacent one
Danger of distortion!



Plug weld the reinforcement plate at the side member-entrance mating surface
Afterwards produce single welding spots so close together that a continuous seam is produced

Important!
Always let the one welding spot cool off slightly before producing the adjacent one
Danger of distortion!



Grind the wheel house and wheel house extension mating surface
Grind the welded surfaces



Crimp the edge of the wheelhouse.



Grind the C-girdle mating surface and grind



Grind the C-girdle mating surface and grind



Grind the side member entrance mating surface and grind



Position and weld the bracket on the side member.
Grind the welded surface.

Distance A = 25 mm

Distance B = 25 mm

Distance C = 25 mm

41 51 REPLACING BEARING SLIDES FOR DOOR HINGES

Remove front or rear door see 41 51 080 or 41 52 080

Note

The bearing sleeve fitted with a hinge section is located on the door in case of the upper hinge and on the body in case of the lower hinge

The hinge section must be protected on the door to replace the upper bearing sleeve

Mark position of door hinge
Repair damaged parts (if any)

Loosen nut and washer
Push out shaft bolt

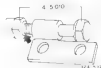
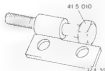
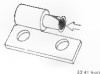
Remove old bearing sleeve

Insert new bearing sleeve

Slide in shaft bolt of Special Tool 41 5 010

Screw on nut of Special Tool 41 5 010 with the cone and lock the sleeve (unscrew nut)

Screw on nut of Special Tool 41 5 010 with the bar and
Press end of sleeve flat
no rotation
Lubricate bearing surface with grease



41 51 580: REMOVING AND INSTALLING
41 52 580: LEFT OR RIGHT FRONT OR
REAR DOOR

Procedures described here were per-
formed on a front door.
Procedures are analogous for rear
doors.



Caution

Be careful not to damage the door
trim panel or paint finish.
Cover with tape if necessary.
Keep loads off of seeds from the door
wire harness.



Unscrew holding frame



Pull plug out of A or B pin.
Pull up clamp. This will disconnect the
plug.



- 1 Hexagon head bolt
- 2 Body and hinge
- 3 Hinge pin
- 4 Door end hinge with bearing sleeve*
- 5 Washer
- 6 Retainer

* Sketch shows the top hinge. Bear-
ing pin is on the opposite end for
the bottom hinge.



Unscrew hexagon head bolts at top
and bottom



Pull off retainer.
Driver out pin upwards.



Lift door out of hinges and place on a
clean surface.

41-61-000 REMOVING AND INSTALLING HOOD ENGINE HOOD

Access

The hose and electric wire for the windshield washer sprayer holders are not provided with connection points. Prior to removal of the engine hood, the windshield washing fluid hose and hose clamping wire harness must be removed from the engine hood.

Disengage the left and right engine hood holders.

Installation

Clamp in the y-plate washers.

Unscrew the left and right shaft bolts with the engine hood off.

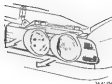
Pre-tightening

Tightening torque is 5 Nm.

41 61 014: ALIGNING ENGINE HOOD

NOTE

Engine hood frame, lip and doors are painted and bottom is an anti-rust body primer. Unpainted surfaces could become visible after refitting and alignment. Such surfaces must be touched up with paint in pertinent body color.



41 61 014

Aligning Engine Hood in Body Opening

Remove left and right radiator grill sections (see 41 12 040)



41 61 014

Loosen screws on lock



41 61 014

Loosen bolts on left and right hood hinges



Align engine hood with the front side panels and on the side



41 61 014

Front Height Adjustment of Engine Hood

Secure on lock, only finger tight. The lock will be aligned in forward direction by lowering the engine hood. Tighten screws.



41 61 014

Adjust the engine hood in height by loosening or tightening the lock. The engine hood is approx. 1 mm (0.039") deeper than the side panels.



41 61 014

After finishing adjustments, unscrew stop bolts far enough that the engine hood doors go down tightly and is in same plane as the side panels.

Adjusting Rear Guide Roller

Loosen screws



Adjust roller outwards and into the guide roller chain into the catch correctly.
Check gap between side panel and engine hood on left and right sides.



Rear Height Adjustment of Engine Hood

Loosen bolts 1 and 2

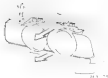
Adjust height as in fig. (2) so that the closed engine hood is in same plane with the side panels.

**41 61 545. REMOVING AND INSTALLING
ON REPLICATING ENGINE
HOOD RIVETS
(Engine Hood Removed)**

Remove

Engine hood, trunk lid and doors are at speed
and bolted in an unfastened position.
Unpainted surfaces could become visible
after subsequent repairs.
These surfaces must then be painted with
pertinent body color paint.

Remove left and right red side grill sections
(see 41 61 040)



Remove hinges on left and right sides.
Align engine hood (see 41 61 014)



41 62 000 REMOVING AND INSTALLING TRUNK LID

Note

Engine hood, trunk lid and doors are aligned and locked in an undrained body state.

Unpainted surfaces could become visible after subsequent alignment.

These surfaces must be touched up with paint in the body color.

The electric supply lead for the trunk lid does not have a disconnection point. This means that the wire harness has to be taken out of the trunk lid.

Remove trunk lid after unscrewing the 6 screws on the left and right sides.



Align trunk lid - see 41 62 014

41-62 014 ALIGNING TRUNK LID

Note

Original hood, trunk lid and doors are formed and painted in an uniform steel body shell. Unpainted surfaces could become visible after subsequent alignment.

These surfaces must be touched up in oil paint as the permanent body color.

Aligning Trunk Lid in Body Opening

Unlock lid in trim panel.

Loosen lock, unscrewing completely if necessary.

Loosen bolts on left and right side.

Align trunk lid with the side panels at the top and rear.

Rear Height Adjustment of Trunk Lid

Center in side panel on left and right sides completely.

If applicable, unsloped in trim panel.

Loosen bolts until the lock can be adjusted. There must be uniform 1/4 inch gaps on left and right sides after closing the trunk lid. Trunk lid should be approx. 1/16 inch (0.039") deeper than the side panels at the rear.

Unscrew stop pads far enough that the trunk lid bears on them lightly and is in the same plane as the side panels.

51 Body equipment

51 0	Notes on repairing plastic components	51	0.1
51 11	Front bumper – remove and install and disassemble	51-	11/1
	Overview of front bumper and mounting parts	51-	11/2
	Spoiler (M5) – remove and install	51	11/5
	Impact box and impact absorber – remove and install/check	51	11/6
51 12	Rear bumper – remove and install and disassemble	51-	12/1
	Rear bumper and mounting parts	51-	12/2
	Impact absorber – remove and install/check	51	12/4
51 13 000	Center trim grille section – remove and install	51-	13/1
040	Side trim section – remove and install	51-	13.1
305	Railing, left or right – remove and install or replace	51-	13/2
336	Front left or right rain channel trim strip – replace	51	13/3
355	Left or right finisher on rear roof pillar (C-pillar) – remove and install	51-	13/4
366	Finisher on roof pillar (C-pillar) – replace	51-	13/4
51 14 000	Front BMW emblem – remove and install	51-	14/1
010	Rear BMW emblem – remove and install	51-	14/1
110	Rear model emblem – replace	51-	14/2
51 16 000	Rear view mirror on left or right front door – remove and install or replace	51-	16.1
026	Mirror glass for rear view mirror – replace	51-	16/2
060	Interior rear view mirror – remove and install or replace	51-	16/2
	Mirror mounting bracket – bond	51-	16/3
200	Oddments tray – remove and install	51-	16/4
360	Right glovebox – remove and install	51-	16/6
51 21	Outside door handle complete with lock cylinder of front door functional description – remove and install and disassemble	51-	21.1
003	Front door catch, left or right – replace	51-	21/7
090	Front door lock, left or right – remove and install or replace	51-	21/8
280	Front door retarder – remove and install	51	21/9
66 10	Batteries for infrared transmitter – change	51-	21/10
	IR receiver – remove and install	51-	21/10
	IR logic stage – remove and install – remove and install	51	21/11
	Display – remove and install	51	21/11
	Key bit – remove and install	51-	21/11
51 22 001	Rear left or right catch (door lock striker) – replace (adjust)	51	22.1
090	Door lock of left or right rear door – remove and install	51	22/2
170	Outer handle of left or right rear door – remove and install or replace	51-	22/3
280	Retarder of left or right rear door – remove and install or replace	51-	22/4
51 24	Rear lid (luggage) – adjust	51	24/1
004	Luggage compartment lock (luggage) – adjust	51	24/1
040	Luggage compartment lid lock and lock support bracket (luggage) – remove and install or replace	51-	24/2
040	Luggage compartment lid lock and lock support bracket – remove and install or replace	51-	24/3
100	Luggage compartment lid lock (lock cylinder) – remove and install or replace	51-	24/4
140	Rear window lock (luggage) – remove and install or replace	51	24/5
300	Left or right gas pressurized spring for luggage compartment lid – remove and install or replace	51	24/5
321	Left or right gas pressurized spring for rear window – remove and install or replace	51-	24/6
51 26	Front left/right outer door handle with lock cylinder – check function	51	26/1
	Luggage compartment lid lock / lock cylinder – check function	51	26/2
	Central locking drives, front and rear doors – check/adjust	51-	26/3
	Central locking drive for luggage compartment lid – check/adjust	51	26/3
	Central locking drives for front left/right doors – adjust	51	26/4
	Central locking drives for rear/left doors – adjust	51	26/5
	Central locking drive for luggage compartment lid – adjust	51-	26/5
000	Switch for front left or right door lock (central locking drive) – replace	51	26/7
010	Switch for rear left or right door lock (central locking drive) – replace	51	26/7
020	Switch for luggage compartment lid lock (central locking drive) – replace	51-	26/8
51 31	Notes on mounting windows	51-	31.1
000	Windscreen – remove and install	51	31/3
200	Rear window – remove and install	51	31/8
	Connection diagram rear window antenna	51-	31/11
200	Rear window (luggage) – remove and install	51-	31/12
201	Rear window (luggage) – adjust	51-	31/12
221	Rear window (luggage, broken window) – replace	51-	31/15
	Stone chip damage on laminated glass windshields (clear and tinted) – repair	51-	31/18
51 32 154	Front door window, left or right – adjust	51-	32/1
170	Front door window, left or right – remove and install	51	32/2
51 33 000	Power window regulator in front door – remove and install	51-	33.1
51 34 154	Rear door window – adjust	51-	34.1
171	Rear door window, left or right – replace	51-	34/2
191	Door window fixed in left or right rear window frame – replace	51-	34/4
51 36 070	Rear left or right side window (luggage) – remove and install	51-	36.1
071	Rear side window (luggage) – left or right – replace	51	36/8
51 37 000	Power window regulator in left or right rear door – remove and install	51-	37/1
240	Window recess cover strip on outside of rear side window (luggage) – remove and install or replace	51-	37/2
251	Window recess cover on inside of left or right rear side window (luggage) – replace	51-	37/3
54 41 000	Front left or right door trim panel – remove and install	51-	41/1
51 42 000	Rear left or right door trim panel – remove and install	51-	42.1
51 43 252	Left or right trim panel for rear roof pillar (D-pillar) – replace	51-	43/1
51 44 011	Headlining (version with sunroof) – (remove and install or) replace	51-	44/1
041	Front section of headlining (version with sunroof) – (remove and install or) replace	51-	44/3
042	Left or right side section of headlining (version with sunroof) – (remove and install or) replace	51	44/4
043	Rear section of headlining (version with sunroof) – (remove and install or) replace	51-	44/5
51 46 030	Trim panel for instrument cluster – remove and install	51-	46/1
180	Bottom left trim panel for instrument cluster – remove and install	51-	46/3
51 47 151	Luggage compartment trim panel for left wheel housing – remove and install or replace	51-	47/1
151	Luggage compartment trim panel for right wheel housing – remove and install or replace	51-	47/2
51 49 000	Trim panel for luggage compartment lid – remove and install or replace	51	49.1
51 71 000	Weatherstrip on left or right front door – remove and install	51-	71.1
	Installation instructions for bonded door weatherstrips	51-	71/1
200	Weatherstrip on left or right rear door – remove and install or replace	51-	71/3
407	Rear spoiler (luggage) – replace	51-	71/3
447	Trim for cover on left or right side member – remove and install	51-	71/5

51-0 INFORMATION FOR REPAIRING PLASTIC PARTS

The conditions mentioned below for plastic parts repair, conform with legislation in Germany. Always conform with pertinent legislation in other countries.

These repairing instructions are provided for qualified workers and assume their skill, carefulness, honesty and sense of responsibility. The instructions are written to factory approved repairing materials and methods as well as associated tips to make the work easier. Only general working procedures are described in these instructions. The degree of repair and order of procedures will always have to be adapted to the permanent damage condition.

Note:
Repairs are an economical option as, as final repair, efficiency cannot be reached. Consequently repairs should only be carried out after receiving customer's approval.

The following 51-34 parts are made of plastic, and can be repaired with 3M 1500 plastic repairing material:

- 51 Technical body measurements

Bumpers

Important:

Only such damage, which does not have influence on the strength and rigidity of the bumper, may be repaired. The following types of damage may not be repaired in the interest of safety:

- Damage on body mounting points
- Damage in immediate vicinity of body mounting points
- Rips/cracks
- Bubbles
- Cracks extending from corners and edges
- Continuous cracks with a length of more than 100 mm
- Holes of over 100 mm² or more

Parts with these types of damage must be replaced.

Refer to the BMW Parking Manual for information on parking plastic parts.

Required Materials

- Carcassum Repair paste, green (e.g. P 30 and P 40)
- Sandpaper - grade 400 and P 150
- 3M Cement Primer 8004
- 3M Aluminium Adhesive Tape Scotch 424
- 3M Green Grid Fabric 9030
- 3M 1500 Plastic Repairing material (black)
- Gloves

Source of Supply: BMW Parts

Safety Precautions

- Extract sanding abrasion
- Wear mask and gloves while grinding
- Wash only those contaminated parts
- Wash hands frequently
- Store tool separately
- Don't eat, drink or smoke while working
- Don't inhale vapors

First Aid

Take off dirty clothes immediately. If dust has gotten in eyes, rinse out with water thoroughly and go to a physician.
If a large amount of vapors is inhaled, go outdoors into the fresh air and, if necessary, visit a physician.

Information on Toxicology

Irritates skin, skin and the respiratory tract. No damaging effects are known as long as breathing is normal.

Measure in Case of Fire

Fire-extinguishing agents: powdering, foam, CO₂, halon, water mist

Disposal

Never let it get into drink water systems.
Single components of the repair material must be disposed at special refuse.
After removing the single components and packaging, it can be brought to the normal refuse station.

Procedures

1. Clean the repair area with plastic cleaner

Acetone

Apply the cleaned surface to all dry at room temperature about 10 minutes before applying the repair material

2. Smooth down the repair surface (grain size: P 80)
Sand out the damaged spot V-shaped (grain size: P 36)
In case of deep damage, clean the back of the repair area with plastic cleaner and sand smooth (grain size: P 36)

3. Remove sanding abrasion

4. Paste aluminum adhesive tape on the face of the damaged spot

5. Cut glass grid cloth to size of the damaged spot

6. Mix the repairing material to instructions of the supplier

7. Apply a coat of repairing material on the back of the damaged spot. Press glass grid cloth over spot, cover it with repairing material and let it harden at room temperature about 20 minutes

8. Pull off the aluminum adhesive tape and, if necessary, sand and clean the repair area again

9. Apply coat of repairing material in the face of the damaged spot and let it harden

10. Smooth down the repaired surface (grit size: P 80). Then grind with glass size: P 180 sandpaper

Important:

The specified grain sizes are absolutely necessary to produce perfect results (no flaking, developments)

Procedures for Repairing Minor Bubbles and Scratches

1. Grind down damaged zone generously (down into the substrate) with dry sanding paper (grain size: 400 - 600)

2. Clean ground area with a plastic cleaner

3. Apply coat of plastic adhesion solution
Apply several coats of BMW rapid filler + 20 % BMW softface additive on the cleaned surface until the shape of the part can be repaired after grinding

4. Grind down filled surface with wet sanding paper (grit size: 800 - 1000)
Continue as described in point 3. If ground through spots or damaged spots are still visible

5. Grind down entire part if applicable (depending on extent of damage)

6. Apply final coat of paint with two-component BMW dry 10 paint + 20 % BMW softface additive. For double-layer insurance, paint finished 20 % softface additive is mixed with the BMW acrylic clear lacquer

Refer to the BMW Paint Spraying Manual for spraying instructions, materials and so on

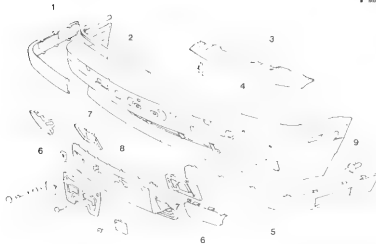
Caution

Use mask and ensure sufficient ventilation
Complies with accident prevention regulations for working with paints
Complies with local and national legislation concerning safety at work and accident prevention as well as working material provisions
Refer to instructions supplied by the manufacturer

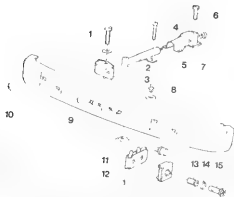
51 11 REMOVING AND INSTALLING AND DISASSEMBLING FRONT BUMPER

Survey of Bumper and Mounting Parts

- 1 Rubber guard, right
- 2 Rubber idel
- 3 Plate
- 4 Panel
- 5 Rubber guard, left
- 6 Cover (front fog lamp)
- 7 Cover (lower eye)
- 8 License plate holder
- 9 Mounting plug



Survey of Bumper and Mounting Parts



- 1 Filter head bolt
- 2 Impact absorber
- 3 Bracket
- 4 Mounting bolt
- 5 Impact bar
- 6 Mounting screw
- 7 Hexagon nut
- 8 Mounting plug
- 9 Member
- 10 Hexagon nut
- 11 Bracket
- 12 Side
- 13 Threaded sleeve
- 14 O-ring
- 15 Retaining cap

51-11/3



24 51 000

Left and right rubber guards on left and right sides.



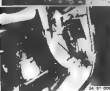
25 51 000

Hook and clip on rubber guards on sides.



26 51 000

Lower bumper on left and right sides
on fenders.
Tightening Torque*
Distance: A) = 5 to 6 mm (0.187 to 0.236 in)
B) around.
Check adjusting if necessary.



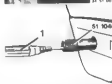
24 51 000

Pull off front bumper forward.
If applicable, disconnect plug for front fog
lamps and connector for headlight
cleaners.



24 51 000

Adjustment
If necessary, adjust bumper to be flush with
the body with Special Tool 51 10 40.



26 51 000

Note
Turn threaded stem with Special Tool
51 10 40 and keep retaining cap tight with
a screwdriver (1).



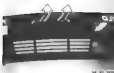
26 51 000

If applicable, fit and fasten for front fog
lamps and temperature sensors.
Left and front fog lamps.
Left and headlight cleaners.

* See Specifications.

51-11/4

1. Lift out expansion rivets.



24 51 000

2. Lift out clamp.
Unscrew license plate holder.



24 51 010

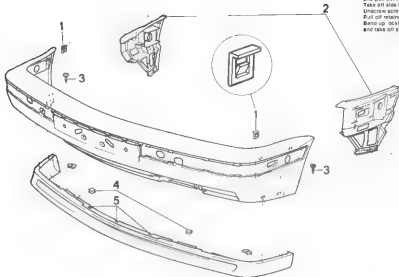
3. Lift out mounting plugs.
Take off trim panel.

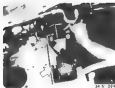


24 51 020

51-11 REMOVING AND INSTALLING SPOILER (M 3)

Remove front bumper – see 51-11
 Press locking hooks into wedges (1)
 and pull out wedges from above
 Take off side inserts (2)
 Unscrew screws (3)
 Pull off retainers (4) toward rear
 Bend up locking hooks (5) on spoiler
 and take off spoiler forward.





34 51 334

51 11 REMOVING AND INSTALLING OR CHECKING IMPACT BOX AND IMPACT ABSORBERS

Remove bumper - see 51 11

Unscrew screws

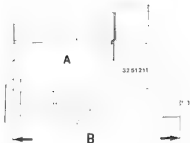
Remove impact box

Installation

Tightening torque*

Control distance "A" $\pm 168 \pm 2$ mm
($\pm 6.61 \pm 0.079$ ") must not be exceeded.
If the front bumper was replaced
after repairing a car damaged in an
accident (impact box is shown
schematically)

Distance "B" for impact absorbers
 275 ± 2 mm (10.826 ± 0.079 ")



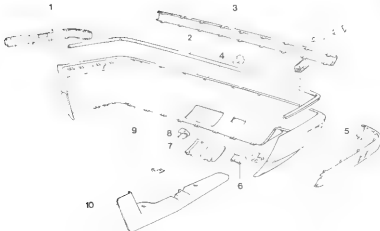
33 51 311

34 51 188

51-12 REMOVING AND INSTALLING AND DISASSEMBLING REAR BUMPER

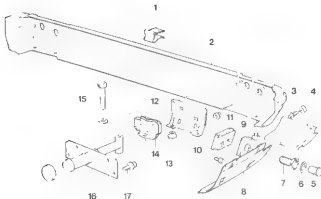
Survey of Bumper and Mounting Parts

- 1 Rubber guard, right
- 2 Rubber seal
- 3 Rubber guard, center
- 4 Mounting plug
- 5 Rubber guard, left
- 6 Cover for towing hook
- 7 Cover for trailer hitch
- 8 Mounting clip
- 9 Trim panel
- 10 Heat shield



51 12 SURVEY OF REAR BUMPER
AND MOUNTING PARTS

- 1 Mounting clip
- 2 Mounting plug
- 3 Mounting plug
- 4 Heat shield
- 5 Retaining cap
- 6 O-ring
- 7 Threaded sleeve
- 8 Heat shield
- 9 O-ring
- 10 Bracket
- 11 Hexagon nut
- 12 Bracket
- 13 Hexagon nut
- 14 Bracket
- 15 Flange head bolt
- 16 Impact absorber
- 17 Hexagon head screw



51-12/3



24 15 148

1. Fit off rubber guard carefully



11 application: Fit off rubber guards on left and right sides



24 15 149

Application:
Hook and pin off rubber guard on sides

24 15 150



24 15 151

Unscrew bolts on left and right sides
Remove bumper
Installation:
Tightening torque*
Check distance "A" = 5 to 8 mm (0.197 to 0.315 ") at adjusted adjusting if necessary

* See Specifications



51 1040

Application:
If necessary, adjust bumper to be flush with the body work (Specs: Page 51 10 40)



24 15 152

Note:
Bump (hooded) close with Special Tool (51 10 40) and front retaining cap tight with a screwdriver

24 15 153



Fit left rubber seal: 1)
Loosen bolts
Remove reinforcement (2)
Left seal (step 12)
Installation:
Tightening torque*

24 15 154



24 15 155

Left seal mounting edge
Remove heat shields

* See Specifications



51-12-000

Lift out mounting plugs.
Take off in panel.



51-12-001

51-12 REMOVING AND INSTALLING OR CHECKING IMPACT ABSORBERS

Remove bumper (see 51-12)

Unscrew bolts

Lift out impact absorbers

Insulation

Tightening torque*



51-12-002

Insulation

Align bracket on impact absorber
when necessary by loosening bolt (1)

Mount bumper and align bracket

Take off bumper again

Tighten bolt (1)

Tightening torque*

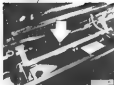


51-12-003

Checking Impact Absorbers

Check that distance "A" is 93 ± 0.5 mm
(3.69 ± 0.020") after repairing a car
which was damaged in an accident

* See Specifications



51-13-000 REMOVING AND INSTALLING CENTER RADIATOR GRILL SECTION

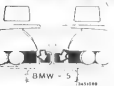
Raise engine hood
Unscrew screws



Guide screwdriver (max. length = approx. 350 mm or 13 7/8" max. blade width = 8 mm or 5/16") on left and right side through opening (1) and lever (2).
Press down locking hook (3) while pulling the front panel forward.

Note:
Headlight assembly was removed for the picture.

Bend up clips and top of front panel forward.



Press down clips and take off front panel forward.



View of Mounting Clips

Insulator
Clip on sides of radiator grill first

Bend open retainers
Take off radiator grill



51-13-040 REMOVING AND INSTALLING SIDE RADIATOR GRILL SECTION

Remove center radiator grill section
see 51-13-000
Unscrew screws
Take off grill

51 13 305 REMOVING AND INSTALLING REPLACING LEFT OR RIGHT RISER

Remove roof liner at front and rear refer
to 51 44 041 and 51 44 042
Remove left or right roof liner section
refer to 51 44 043



Remove rubber plug and unscrew screws
Loosen rear hose clamp 1) and pull the
water drain hose off



Press the water hose downwards and
unscrew the screw
Remove the roof railing





51-13-106 REPLACING LEFT OR RIGHT FRONT RAIN CHANNEL STRIP

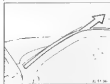
Removal

Apply Special Tool 51-1-118 to the rain channel and bring it upwards.

Caution

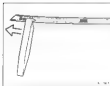
Don't scratch the rain channel panel.

Push the clips separately forward into the cover panel (A plate).



Open the rear door and using the plate C-glass.

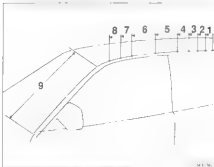
Open the front door, pull the rain channel strip forward slightly and pull it upwards off on the cover panel.



Slide the clips out of the rain channel strip.

Note/Action

Always replace damaged clips!



Inserting
insert clips on the rain channel

Clip Spacing Distances

1	• 42 mm	type strip plate
2-5	• 60 mm	(C-glass) parts
4-5+8	• 100 mm	
7-8	• 60 mm	
9	• 4 clips spaced uniformly	

Gap between the C-glass plate and rain channel strip: steps 3-5 mm

Apply the rain channel strip and clip the C-glass plate in. Beginning at the rear, press down on the rain channel strip with 8 steps into the clips.

- 51 13 305 REMOVING AND INSTALLING
PANEL, ON LEFT OR RIGHT
REAR ROOF PILLAR (C Pillar)
51 13 306 REMOVING AND INSTALLING
PANEL, ON REAR
PILLAR (C Pillar)



Put off edge guards in rear door opening
and on side to follow partially
striping Caplar panel



Decup (1) and fit put (2) back on side



Lift out cap and unscrew screws.
Remove Caplar panel on outside and put
it out of seat

51 14 000 REMOVING AND INSTALLING FRONT BMW EMBLEM

Left side emblem carefully



Inspection or not

Replace plastic clip, if necessary
Use Tensitape tape, if necessary



20 51 000

51 14 010 REMOVING AND INSTALLING REAR BMW EMBLEM

Left side emblem carefully



1. Step



Inspection or

Replace plastic clip, if necessary
Use Tensitape tape, if necessary



20 51 000

51-14/2

5114510 REPLACING REAR MODEL SIGN

The model sign is cemented and cannot be reused.

Coat a paper strip or glass with Teflon (e.g. with washing detergent) and stir through coat of cement between trunk lid and model sign.

Remove residual cement on trunk lid with gauze or

Model sign may only be installed at room temperature.

Locate tape up to upper edge "C" and mark distances according to table.

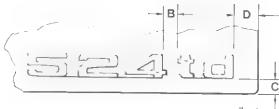
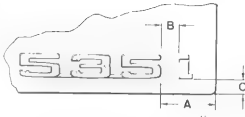
Heat model sign to approx. 40 - 50°C (105 to 120°F) and press on for 5 to 10 seconds.

Distances in mm (inches):

BMW Models	A	B	C	D
520i, 528i, 540i, 524td	18 (0.709)	18 (0.709)	26 (1.024)	
524td		21 (0.827)	18 (0.709)	26 (1.024)

Note:

Model sign must be removed when baking paint at temperatures above 80°C (176°F).





51-16-000 REMOVE HO AND MOUNTING OR REPLACING MIRROR ON LEFT OR RIGHT FRONT DOOR

Unclip cap at top rear.
Push up and remove cap.



Models with Sound System

Uncover mirror.
Unclip loudspeaker at top and remove.
Pull plug off of loudspeaker.



Push foam rubber spring out of cover.



Uncover mirror and remove door.



Adjustment

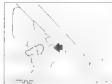
Switch on ignition and check function.

Switch positions:

1 = Left outside mirror
2 = Right outside mirror

Mirror adjustments:

3, 4 = Vertical plane
5, 6 = Horizontal plane



Uncover mirror.

Disconnect plug and remove mirror.



51-16 180

51-16 180 REPLACING GLASS FOR MIRROR

Insert screwdriver in housing opening (bottom) and turn the retaining ring.

- 1 - Unlocked
- 2 - Locked

Note:

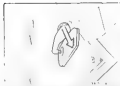
Unlocking and locking will be noticed strongly when turning the retaining ring.

Heated Outside Mirror

Pull off the male plug and connect it on the new mirror glass.

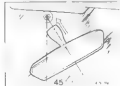


51-16 184



51-16 060 REMOVING AND INSTALLING OR REPLACING MIRROR ON INSIDE OF CAR

Pull mirror back off of the mirror socket.



INSTALLATION

1. Connect mirror base on the mirror socket with an approx. 45° turn
2. Turn mirror base until it engages on the mirror socket

51 16 CEMENTED MIRROR BASE

Material Requirements

Mirror base cementing repair kit¹
 Primer 300 7702

1 Preparations

1.1 Cement at room temperature and make sure that in good weather the window glass, and base are brought to room temperature in the workshop long enough, in order to prevent moisture on the surface

1.2 Mark position of mirror base on outside of the wingglass
 Scratch off old cement on glass and base with a sharp tool

1.3 Thoroughly clean cementing surface on glass and base with a clean sheet wool cloth and acetone before and at surface dry²
 Never use paint thinner

2 Primer Coat

Apply colorless, diluted primer on surface of a substrate intended for cementing with help of cotton tips (Q-Tips or something similar)

Air drying time: at least 1 minute, max. 1 hour

3 Cement Coat

3.1 Mixing Cement

Put all sealing tips on containers of cement and hardener using a syringe. Make sure that both openings are equal in size, so otherwise there would be mistakes in mixing

The sealing cap for subsequent plugging of the double injector is located between both pistons of the injector. Break off sealing cap

The required amount of cement and hardener is removed by applying light pressure on the pistons. The mixing ratio for cement and hardener is 1 to 1 (weight and volume). It is important that the same volumes of cement and hardener are removed (for more use of openings if necessary)

Both components react chemically with each other. Thorough, intensive and homogeneous mixing is a requirement for this reaction and for the quality of cementing

Consequently both components must be mixed in such a manner that there is an uniform, free from seams mixture color

3.2 Application

At 20 to 25 °C the mixture has an application time (potlife) of about 5 to 10 minutes. Apply a thin (approx. 0.5 mm thick) and uniform coat of cement on the base using a spatula and press the base on the glass in such a manner that the cement has good contact with the glass over the entire surface

Note

The temperature for the hardening process should not be lower than + 10° C

3.3 Fixing Base on Parts

Epoxide resin cements do not have an initial strength property. This makes the fixing of bonded parts necessary (adhesive tape or something similar). The joining and fixing of bonded parts must be accomplished within the potlife. Check that the mounting button is positioned correctly on the mirror base, so that the mirror mounted later will be straight along side of mirror base hexagon parallel to upper edge of wingglass

3.4 Hardening of Cement

Hardening speed depends on the ambient temperature. Consequently the mirror base must be fixed with adhesive tape or something similar for at least 3 to 4 hours. Buffing on the mirror at the earliest after 10 hours

4 Working Hygiene

4.1 Skin

Cement is dangerous for health when vapors are inhaled or through contact with the skin. As is the case for all epoxide resins, sensitive persons might be confronted with skin allergy (itching) in contact with the glue

If the product gets on the skin, wash off with water and soap immediately. If it gets in an eye, rinse the concerned eye thoroughly in water and go to a physician

Make sure that the room is well-ventilated and gloves are worn for the application of cement

¹ Source of Supply: BMW Parts

51 16 200 REMOVING AND INSTALLING CENTER CONSOLE

Remove trim panel for dashboard at bottom left



M 5
Remove rear seat center armrest - see Group 52
Lift out plate
Pull off plugs

Unscrew screws
Remove center console

Lift out plate



Pull off plugs
Unscrew screws

If applicable, lift out cassette box and pull off electric leads for lighting

Lift trim panel off of parking brake lever
Lift out plate (1)
Unscrew screws
Lift out rear center console section

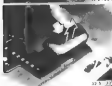
Unscrew screws
Lift out section



20 51137



20 51138



20 51139



Pull off plugs.

Cars with Manual Transmission
Pull off the cover knob
Lift out dust cover
Remove cover

Cars with Automatic Transmission
Unscrew screws
Pull off the cover knob

Lift out cover
Pull off plug



If applicable remove radio - see
Group 65

Lift out heater controls
Pull off plugs
Refer to Group 64

Unscrew screws and lift out trim
panels on left and right sides

Lift out plate
unscrew screws
Lift out center console



51-16/6-1

51-16/6 REMOVING AND INSTALLING GLOVE BOX

1. Pull out this
Pull glove retaining straps



Unlocks brackets on left and right sides
Left glove glove box



51-16/6-3

Illustration
Glove in lock with tab facing forward



51-16/6-4

Illustration
Align and clip on glove box in closed state
(Arrows indicated in picture)



51-16/6-5

51 21 REMOVED AND INSTALLING AND DISASSEMBLING FRONT DOOR OUTSIDE HANDLE COMPLETE WITH LOCK CYLINDER INCLUDING DESCRIPTION OF FUNCTION

Electronic central locking (CZ) unlocks and locks all four doors, trunk lid and tank flap. It can be initiated from the locks of the front doors and trunk lid.

Central arresting (ZB) prevents the pulling up of catch buttons on the doors. Central arresting (or double locking) is only possible from the locks of both front doors.

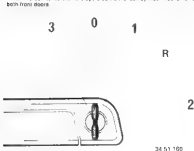
Three microswitches each are operated via the lock cylinder mechanism of both front doors.

Unlocking or Locking Mechanically

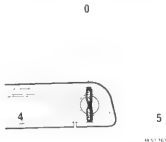
Both front doors can be unlocked or locked mechanically in case of fault in the central locking system or failure of the car's battery.

Note:

If locked, only the front passenger's door of cars produced after 8/88 can be unlocked mechanically.



34 51 100



44 51 101

- 1 = Locking, the first microswitch responds. Key turned about 35° and the "locking" function is activated.
- R = Catch, intermediate position for "arresting", the second microswitch responds. Key turned about 45° and the "arresting" function is activated.
- 2 = Arresting, key turned about 85°
- 3 = Unlocking, the second microswitch responds again. Key turned counter-clockwise about 25° and the "unlocking" function is activated. Key can be pulled out only in position "0".

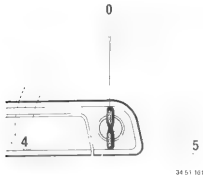
- 4 = Mechanical unlocking, door handle lifted and key turned past noticeable resistance to position "4" (about 110°).
- 5 = Mechanical locking, key turned past noticeable resistance to position "5" (about 110°).

SYNCHRONIZATION OF LOCKS

Synchronization of the lock is necessary if the locking system is "asynchronous".

The locks are "asynchronous" if for example

- The lock of a door in an activated locking system was unlocked mechanically only as far as possible on the front passenger's door of vehicles produced since 9/99.
- The locks had been locked centrally with the driver's door open (in vehicles produced since 9/99 central locking with an opened driver's door is possible without raising the locks "asynchronous").



Synchronizing Locks (only still possible on the front passenger's door of vehicles produced since 9/99)

- Lock the locks mechanically (double-lock, by turning the key beyond noticeable resistance into position (5) (approximately 110°).

**Caution**

The lock cylinder can only be removed and installed with the main key!

Installation note

Check function
refer to 51 21

Remove door trim panel as before,
refer to 51 41 000
Close door window

Caution

For safety reasons, disconnected plug connector
from window regulator motor

Lift out covering.

Push forward catch with special tool 51 2 190

Note

Secure handle finisher panel to prevent it
dropping.

Installation note

Ensure the rubber seal is fitted correctly
Press handle finisher panel against body

**Installation note**

Pull in catch with special tool 51 2 190

Lift out retainer

Detach linkage

Installation note

Regulator latch in position "closed" lock in
position "closed"

Release screw

Release nail with tool 51 2 070
Lift out complete door handle

Disconnect plug connector

Installation note

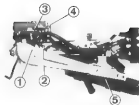
Forward plug connectors only fit in mating
socket.



Push the return back.
Pull the plug off.



Unscrew the screws.
Remove the metal panel.



24 51 21

View of Door Handle Assembly

- 1 = Lock cylinder
- 2 = Door lock heater
- 3 = Microswitch
(Locking device)
- 4 = Microswitch
(Door lock heater)
- 5 = Central lock drive
(Basic setting about the center of the slot)



Cut off wire at top.
Open the plug receptacle.
Disconnect the plug.

- 1 = Door lock heater microswitch
- 2 = Door lock heater
- 3 = Lock plug contact
- 4 = Terminal 30 and burglar alarm

Installation
Check for correct seating of the locking
bolts.

22 51 17



Caution!
Clamp has strong spring force.
Wear protective goggles.

Lift the clamp out.
Remove the microswitch.



Caution!
Clamp has strong spring force.
Wear protective goggles.

Lift the clamp out.
Remove the microswitch together with the housing.

Information
Microswitches are marked with
L for left or
R for right.

51-21/5-1

51-21/5-2

Remove microswitch



51-21/5-3



51-21/5-4

Warning
Lift the drive out

Information
Adjust drive - refer to 51-26



51-21/5-5

Disconnecting Lock Cylinder
Insert the master key into the lock cylinder

Note
Correct removal and installation of the lock
cylinder are only possible with the master
key!

Important!
Don't damage the notched pin and bore.
Press the notched pin out using a pointed
piece (don't knock it out!).



51-21/5-6

Squeeze the lock cylinder together (slight
tension)



51-21/5-7

Lift the cam sleeve off carefully so that the
spring remains in the cam sleeve



51-21/5-8

Installation
Insert the cam sleeve correctly

Installation
Insert the spring correctly



34 51 078

Installation
Insert the catch in such a manner that the wedge tip points away from the spring. See an arrow



34 51 089

1. fit the complete emergency unlocking mechanism off the linkage and do not disassemble further if possible

Notes
The emergency unlocking mechanism is only installed on the front passenger's side of vehicles produced since 8/89. This emergency unlocking mechanism is then a single component which cannot be disassembled.



34 51 079

Installation
Assemble the emergency unlocking mechanism in normal position

1 = Normal position
2 = Emergency unlocked position



34 51 080

Installation
Adjust the sleeve (1) to the center of opening (2).
The latter is, top left or top right on the washer faces up.



34 51 081

Installation
Assemble the emergency unlocking



34 51 082

1. fit the sleeve out carefully

Installation
Insert the sleeve with tongue (1), facing up



34 51 083

Put the lock cylinder out carefully

Installation
Push the key holder down using a pointed tool.
Push the lock cylinder in completely and hold it in until the notched pin is inserted into the cam sleeve.



34 51 084



Hold the spring and ball in position with grease*
Check for correct seating of the ball and spring



21 21 001



21 21 004

Installation:
The ball side of the lock cylinder faces up
Lubricate the tumblers with grease*

When using a repair kit lock cylinder the old tumblers must be used as spacers.
Take the tumbler out of the old lock cylinder and note the stamped number.
Insert new tumbler having the same stamped number in the permanent chamber logic door with new spring and supplied grease.
Proceed in the same manner with the remaining tumblers.

* Source of Supply: BMW Parts



21 21 002



21 21 003



21 21 004



21 21 005

21 21 000 REPLACING LEFT OR RIGHT FRONT DOOR STRIKER

Mark the installed position of the door striker with a pencil

Important:
Prevent the threaded plate in the 8-pole from falling down.

Unscrew (loosen) and remove the door striker

Installation:
Tightening torque*

Disconnect the plug

Installation:
Check the switch

Switch opened = continuously
Switch pressed = break

Installation:
Screw the door striker on lightly and align it with the door lock

Adjustment:
Adjust the door striker so that the outside surface of the closed front door is 1 mm from or up to the outside surface of the rear

* Refer to Specifications

51 21 000 REMOVING AND INSTALLING RETRACTED LEFT OR RIGHT FRONT DOOR LOCK

PRELIMINARY Check function

Remove from door trim panel - refer to
51 41 000
Raise the door window

Caution
Disconnect the power window motor plug
in the interest of safety

Put the lower window guide out of the
window guide rail
Disconnect roller
Pull the window guide rail downwards

Installation
Attach the window guide rail at top in the
opening of the door panel with the hook.
Check for correct seating.



51 21 100

Installation
Lubricate the door lock with grease*
Check function

Remove the roller
Disconnect the linkage

Precaution
Rotate lock in "locked position" and lock in
"locked" position

Pull the rubber door seal off partially
Unscrew screws
Remove the door lock



51-21-000 REMOVING AND INSTALLING FRONT DOOR RETARDER

Remove front door trim panel - refer to
51-41-000

Caution:

Disconnect the power window motor plug
in the interest of safety

Unscrew the lockplate
Drive the pin out upwards

Lift the rubber cover out
Unscrew screws and remove the door
retarder towards the inside

Installation
Lubricate the door retarder with grease*

50 10 REPLACING BATTERIES FOR INFRARED SENDE

Fold the key out
unlock the screw



50 10 004

Fold the key in
swing the cover out



50 10 005

IMPORTANT!
If the battery replacement described below
is accomplished within one minute, the
system does not have to be initialized
again!

Unscrew screw
Remove batteries



50 10 006

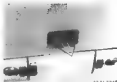
INSTALLATION
Insert the batteries correctly



50 10 007

55 10 REMOVING AND INSTALLING INFRARED RECEIVER

Pull the receiver out



55 10 004

Disconnect the plug



55 10 005



66-10 REMOVING AND INSTALLING REAR LOGIC UNIT

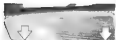
Remove the left rear seat (or rear seat cushions - refer to Group 52)
Pull the rear logic unit out



66-10 REMOVING AND INSTALLING KEY BIT

Speed-in-wheel sensors can be supplied without the key bit
To exchange the key bit: unscrew the screw and replace the key bit

Installation:
Use a new screw and lock at end of threads



66-10 REMOVING AND INSTALLING DISPLAY GRID

Detach screen.
Remove vent display grid



Disconnect the plug.
Unscrew screen and lift the display unit out

51-21-001 REPLACING ADJUSTING LEFT OR RIGHT REAR DOOR STRIKER



Installation
Adjust door striker that outside surface of
closed door is 1 mm further out than out-
side surface of rear side panel.
Tighten door striker screws.
Tightening torque*



Note
If necessary, mark related position with a
pencil.

Unscrew screws and fit out door striker.

Inspection
Tightening torque*



Disconnect plug.

Inspection
Check switch.

Switch opened = power flow
Switch pressed = interruption



Installation
Screw on door striker only finger-tight and
align with door lock.

51-22-000 REMOVE AND INSTALLING LEFT OR RIGHT REAR DOOR LOCK

PRECAUTION:
Check function

Remove door from panel Refer to
51-43-000

CAUTION:
Disconnect plug in power window motor
in the interest of safety

Remove screw

Remove it
Disconnect cable

Loosen screws
Remove lock

Installation
Tightening torque*



51-22-000

PRECAUTION:
Lubricate door lock with grease**
Check function



* Refer to Specifications

** Source of Supply: Nissei Parts

51 22 170 Removing and installing or replacing outer handle of left or right rear door

Check function

Remove door trim panel, refer to 51 42 000

Caution

For safety reasons, disconnect plug connector from window regulator motor



Installation note

Push in catch with special tool 51 3 180

Reattach screws and reinsert outside handle



275 044

Lift out covering

Push forward catch with special tool 51 3 180

Note

Secure handle finisher panel to prevent it dropping

Installation note

Check handle fit after panel is fitted correctly and press against body



51 22 260 REMOVE MO AND INSTALL MO
ON REPAIR MO LEFT ON
RIGHT REAR DOOR
RETAINER

Remove door trim panel refer to
51 41 800

Caution

Disconnect the power window motor plug
in the interest of safety



11 22 260

Unscrew lockplate
Drive door pin upwards



12 22 260

Lift out rubber cover
Unscrew screws and remove door retainer
towards the inside



22 22 260

Apply grease
Lubricate door weather with grease**

** Source of Supply: BMW Parts

51-24/1



51 24 ADJUSTING TAILGATE (Towing)

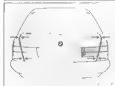
Remove tailgate gas pressure prods refer to 51 24 300

Raise the tailgate

Use the pins out towards the rear



Adjust the left and right screws



Adjust the tailgate to have equal but gaps on the left and right sides and be flush with the body

51 24 004 ADJUSTING TAILGATE LOCK (Towing)

The following parts must be removed or disconnected

Requirement — tailgate adjusted correctly

- Tailgate lock cover section (adjust stop pins)

**51 24 040 REMOVAL AND INSTALLING
REPLACING TAILGATE LOCK
AND LOCK SHOCKLE
(Towing)**

The following parts must be removed or
disconnected

- Tailgate lock (actual)
- Tailgate trim panel (removed)
- Lock upper section
- Operating rod
- Microswitch
- Drive motor
- Tailgate lock lower section

51 24 048 REMOVING AND INSTALLING REPLACING TRUNK LID LOCK AND LOCK SHACKLE

PREPARATION
Check function.

Put the trim panel off partially.

Unscrew screws.

Depress the linkage.
Disconnect the plug
L in the trunk lid lock (not removed in the
picture).

PRECAUTION
if necessary, eliminate the linkage play by
turning the ball socket.

Lift the plate out.
Unscrew screws.

Adjust the lock shackle by sliding it in the
groove.

Adjust the rubber pads by turning them to
have the trunk lid bear on them with slight
pressure.

Checking
The top surface of a closed trunk lid should
be in the same plane as the edges of the
side panels.





51 24 400 REMOVING AND INSTALLING REPLACING TRUNK LID LOCK (LOCK CYLINDER)

Préparation
Check function

Pull the trim panel off partially



Disconnect the plug
Disengage the plug



Install lock
Turn lock cylinder plug by turning the lock
socket on the trunk lid lock
Adjust central lock drive - refer to 51 24

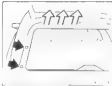


Unscrew screws
Remove lock

**51 24 140 REMOVING AND INSTALLING
REPLACING TAILGATE WIN-
DOW LOCK (Towing)**

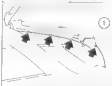
The following parts must be removed or
reconnected:

- Tailgate trim panel
- Lock lower section
- Driver's side
- Microswitch



**51 24 300 REMOVING AND INSTALLING
REPLACING LEFT OR RIGHT
GAS PRESSURE PROP FOR
TAILGATE (Towing)**

Open the tailgate window.
Remove rubber pads (1) and unscrew the
screws.
Remove the plate supports.

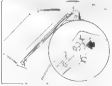


Raise the tailgate
using the prop (1) on the side and remove
the plate.

Installation
Replace damaged clips if necessary.



Remove the spring retainer
with the gas pressure prop out.



Unscrew the screws and remove the gas pres-
sure prop.



51 24 321 REMOVING AND INSTALLING RUBBER GROMMET (1) LEFT OR RIGHT GAS PRESSURE PROP FOR TAU/GATE WINDOW (hooding)

Open tailgate window
 • Lift out rubber grommet (1) and unscrew screws
 • Lift out panel at top



Raise tailgate window (1) and lift out at side and remove panel

Inspect grommet
 If necessary, replace damaged clip



Loosen with screw (1)
 Slide the clip towards the inside and remove the rubber



Push the hose aside slightly
 Unscrew screws and remove holder

Installation
 Route the hose correctly



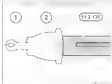
Pull off retainer (1)
 Pull off gas pressure prop (2)



Slide Special Tool 51 2 130 over the gas pressure prop with the slot at bottom, until the mark is aligned with the pin



Push the rear end of the special tool down to unlock the gas pressure prop



Installation
 Slide the gas pressure prop (1) into the special tool and push the rubber grommet (2) Replace a damaged rubber grommet if necessary



475-2127-01

Press new gas pressure prop onto right
 ear and push in installing rod carefully.
 Check for correct seating of rubber grom-
 met (2).

51-26 CHECKING FUNCTION OF LEFT OR RIGHT FRONT DOOR OUTSIDE HANDLE WITH LOCK CYLINDER

Note:

The vehicle functions can only be checked visually as the special equipment is installed in the car.

Turn on ignition.

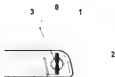
Lower all windows.

Open the power sun roof.

Turn off ignition.

Unplug and lock driver's door.

Lock all other doors (trunk lid and tank flap).



Lock doors – key position (1).

Double-lock doors – top position (2) about 40 seconds (heats). Check buttons cannot be pulled up and burglar alarm is set.

Unlock doors – key position (2) burglar alarm is unactivated.

Check unlocking of tank flap and trunk lid. Insert as the trunk lid lock is not in "double locked" position (2) is set after to checking fuel on oil trunk lid lock/clock cylinder.

Unlock door manually – position (4).



Lock door manually (includes synchronization of the locking system) – key position (3).

Switch on door lock heating and inside light delay by:

a) locking doors again.

b) waiting at least 35 seconds after locking and

c) lifting the door handle at least 5 seconds – the inside lights will be switched on and off again after about 5 seconds.

Door lock heating is switched on for about 40 seconds. It can be switched on again afterwards by lifting the door handle. Door locking heating can be activated only 3 times within 10 minutes. Interlocking is activated for 10 minutes afterwards, but this can be canceled by unlocking and locking the car.

Check heating of lock cylinder with a thumb. Rechecking door lock heating if necessary.

Note:

Door locking heating and inside light delay can only be operated from the driver's door lock.

Operate the comfort closing of power windows and power sun roof by holding the key in position (1) or (2).

Check locking of trunk lid and tank flap.

Note:

See Group 51 Test Plan in case of Rev. 1a.





SA 51 164

51 26 CHECKING FUNCTION OF TRUNK LID LOCK LOCK CYLINDER

Lock = key position (1)

Double-lock = key position (2)

Trunk lid remains locked. If door lock is unlocked

Unlock = key position (3)

Note:

Refer to Group 51 Test Plan in case of trouble

51 2th ADJUSTING CENTRAL LOCK DRIVE OF LEFT OR RIGHT FRONT DOOR

Requirements

Use master key

Locking system is synchronized - see

51 21

Close door window

Remove door trim panel - see

51 41 000

Caution

Pull off plug on power window motor
in the interest of safety

Loosen central lock drive screws

Compress central lock drive and pull
forward without force until there is no
play

Tighten screws of central lock drive in
this position

Tightening torque = 2 Nm (1.5 ft. lbs.)



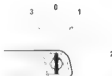
Turn striker (D) to closed position 2
(2nd catch)

1 = Opened

2 = Closed



Double lock car on the opened door -
key position (2) (double lock heard car on)



Unlock car - key position (2)



Let door handle and both striker back
into opened position 1 with a pencil or
something similar

1 = Opened

2 = Closed

Check function

51 25. ADJUSTING CENTRAL LOCK DRIVER OF LEFT OR RIGHT REAR DOOR

Requirements:

Use master key

Locking system is synchronized - see
51 21

Close door window

Remove door trim panel - see
51 42 000

Caution:

Pull plug off of power window motor in
the interest of safety

Double-lock car from lock of driver's or
front passenger's door - key position
(2) (loud click heard twice)

Loosen screws of central lock drive

Compress central lock drive and pull it
down without force until there is no
play
Tighten screws of central lock drive in
this position.
Tightening torque = 2 Nm (1.5 ft. lbs.)

Check function

51 26. ADJUSTING CENTRAL LOCK DRIVE OF TRUNK LID

Requirements:

Use master key

Locking system is synchronized - see
51 21

Release trunk lid

Lift off trim panel partially

Turn key in trunk lid lock (lock
cylinder) to "double-locked" position
(2) - key horizontal

Remove key

Important:

Don't leave the key in the trunk!

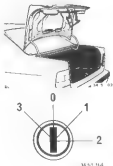
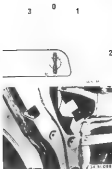




Fig. 5. 15

Loosen screws of central lock drive



Fig. 5. 16

Pull central lock drive to the left away from the lock) without force until there is no play
Tighten screws of central lock drive in this position
Tightening torque = 2 Nm (1.5 ft. lbs.)

Check function

51 26 000 REPLACING SWITCH FOR LEFT OR RIGHT FRONT DOOR LOCK (CENTRAL LOCK DRIVE)

Remove front door trim panel - see
51 41 000

Caution

Pull off plug on power window motor
in the interest of safety

Installation

Adjust central lock drive - see

51 26

Pull back retainer
Lift out plug

Unscrew screws.
Lift out drive

Installation

Check for correct seating of linkage on
the drive (shims removed)

51 26 010 REPLACING SWITCH FOR LEFT OR RIGHT REAR DOOR LOCK (CENTRAL LOCK DRIVE)

Remove rear door trim panel - see
51 42 000

Caution

Pull off plug on power window motor
in the interest of safety

Installation

Adjust central lock drive - see

51 26

Pull back retainer
Lift out plug

Unscrew screws
Lift out drive

Installation

Check for correct seating of drive on
the actuator (shims removed)



23 51 31



24 51 00

51-26-020 REPLACING SWITCH FOR TRUNK LID LOCK (CENTRAL LOCK DRIVE)

Disconnect trim panel partially

Illustration

Adjust central lock drive - see
51-26



38 51 105 1



38 51 105 2

Disconnect linkage.

Unscrew screws
Remove drive

51-31 Notes on window installation

The windshield and rear window (also rear side windows on E34 touring) are cemented (glued) very tightly to the body. This improves the structural strength of the vehicle. The following procedure described in the following must be complied with in order to guarantee correctly cemented windows.

Two different repair cases are described:

1. When replacing the windshield or rear window, the retaining clips of the decorative trim frame are already lifted on the window glass.
2. When removing and installing the windshield or rear window, the retaining clips of the decorative trim strips must be lifted by hand.

Notes

When using Sika[®]ack - Ultrafast (hot fast) fast the cement cartridge must be heated to 80 °C for one hour in a cartridge heating oven.

Before placing cartridge in oven, place aluminium cover at rear end.

Removal¹⁾

The cement bonding of the window glass is cut through with an electric cutting disc with an oscillating wheel, without damaging paintwork around the body aperture. Protect as goggles and gloves must be worn when cutting out windows.

Paintwork damage at the body aperture must be repaired with BMW (EP) prime filler²⁾. Large damaged areas must be ground down to bare metal and coated with BMW (EP) primer filler (grey) primer (thickness 20 - 40 µm). If complete build-up of paint finish is required in a visible area, the primer coated cement flange must be covered with adhesive tape prior to application of the final coat of paint.

Preparing for assembly

Notes

When using Sika[®]ack - Ultrafast (hot treatment)

Before applying, cement cartridge must be heated to 80 °C for one hour in oven.

Heated cement can be heated several times and remains stable at 80 °C for approx. 72 hours.

The window is coated with a 1,1,1-trichloroethylene (permeable) material on the inside edges to protect the cement bonding.

A PVC lip is applied over the edge of the circumference of the side window (E34 touring). This lip must have its irregularities within 24h after the application of the cement bonding.

In the event of possible car theft on the PVC, the PVC coating must be treated as follows in the changing area when replacing a side window (E34 touring):

- Roughen surface with sanding paper 220 grain size
- Clean twice with 2-propanol (100 % alcohol)
- Drying time approx. 1 minute
- Apply black primer 5051²⁾ (Kauri-Essenz)
- Drying time approx. 10 minutes
- Use cement Sika[®]ack 220-FC or Sika[®]ack - Ultrafast²⁾

Caution!

The PVC coating of the side window (touring) must not be treated with Sika (Chapter 30).

The dry seal glass (sealer surface of windshield or rear window with cleaner (2-partner 220 repair lip). The primer must be allowed to air for at least 10 minutes. Clean body aperture with 2-propanol (100 % alcohol, available from pharmacies). Only use the 1-component polyurethane cements approved by BMW (Sika[®]ack 220-FC for spot treatment or Sika[®]ack - Ultrafast for full treatment). To apply uniform cement bead to window, use cartridge gun operated with compressed air or electric power.

Assembly

Caution

Assembly must be completed within 10 minutes otherwise the cement bonding will form a skin thus preventing satisfactory bonding.

Before a finished, cement all cement residue with a scraper (Sika remover 208). With a scraper, do not press out the window glass again. Hardened cement can only be removed by machine.

The vehicle can be towed or driven without a windshield, rear or side window.

A side window should be applied to prevent pressure building up in the passenger compartment when closing doors.

¹⁾ Source of supply: BMW Parts Service

²⁾ Source of supply: BMW Parts Service

The cement hardens by means of a reaction with air moisture at room temperature. The minimum hardening time is achieved at 22 °C and 38 % relative humidity, refer to table.

The vehicle must not be subjected to one-sided loads during the minimum hardening time (for example having one wheel up on the faulty workshop floor etc.) Park on level ground at the workshop.

Cements and minimum hardening times

Cement	Minimum hardening time without front passenger's airbag (vehicle can be driven)	Minimum hardening time with front passenger's airbag (countries without compulsory belt regulations)
Baufix 200 (C1)	4 hours	20 hours
Build (rediment)		
SmuTack (Wireless)	2 hours	10 hours**
Pro (treatment)		

** Note:

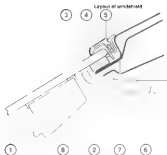
In the case of vehicles with front passenger's airbag, the vehicle can be handed over to the customer after the hardening time has elapsed (vehicle can be driven). Dependent on cement with the following warning:

All passengers must wear seat belt after connecting air conditioner, speed limit maximum by driving time (refer to table, countries without compulsory belt regulations)

51 31 000 Removing and installing windshield

Observe notes on cementing windows, refer to 51 31

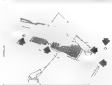
Remove both upper arms, refer to 51 51 100



- 1 Windshield
- 2 Cement bedding
- 3 Adhesive film
- 4 Clip
- 5 Ornamental trim frame
- 6 Headlining panel
- 7 Body
- 8 Inner rear view mirror



Only hot treatment with SiluTack Ultraflex
Before inserting cartridge in oven, pre-heat aluminium cover at rear and heat cement cartridge to 80°C for one hour in oven!



Lift out clips
Remove covering



Slide covering to one side



Lever out film mouldings
Repair defective trim mouldings if necessary



Lift out sun visor and remove screen.
Remove sun visor and hinged bracket

Version with interior light package
Disconnect plug connector from sun visor and
hinged bracket



Partly remove door weatherstripping



Lift out & pillar trim panel



Push mirror back and remove from mirror
socket

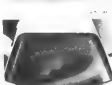


Installation note

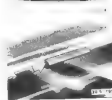
- 1 Fit mirror base on mirror socket turned by
approx. 45°
- 2 Turn mirror base until it engages on the
mirror socket.



Slightly pull down headlining



Mark off body



Level out clips



FN knife blade* on tool
If necessary, replace the knife blade with machine run-down.



Carefully insert knife* between body and windshield



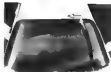
Guide web of knife parallel to windshield



Cut through cement bead as close as possible to the windshield

- 1 Body aperture
- 2 Cement bead
- 3 Knife
- 4 Windshield

* Source of supply: BMW Parts Service



20 9-0-04

Cut through cement bead as round and lift out windshield with special tool 51-31-010



Cut off old cement on body aperture down to a thickness of approx. 0.5 mm

Cut off old cement carefully with a general purpose knife (sharp or razor blade) to avoid damaging the paint finish in the body aperture



20 1-100-04

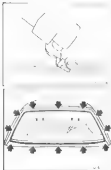
Caution*

Damaged paint finish must always be repaired to guarantee long-term corrosion protection. For this purpose, use **BMW EP** prime later (p. 67).

Remove residual cement, sand out scratches in areas not visible and touch up with BMW EP prime later.

Large damaged spots must be ground down to bare metal and coated with BMW prime later (PR) (layer thickness 30 - 40 µg). If complete build-up of paint finish is required in a visible area, the prime-coated cement flange must be covered with adhesive tape prior to application of the final coat paint.

* Source of supply: BMW Parts Service



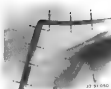
When re-using the windshield:
 Move cement residue on windshield with knife to approx. 10 mm

Caution:
 The BMW BIP primer filler must be completely hardened!

Coat windshield and body in area of bonding surface with primer (repair kit)*

Drying time approx. 10 minutes

When re-using the windshield:
 Fit clips by hand!
 Pull off protective film from adhesive strips



Mark windshield corresponding to outside fit trim moldings:
 Centre of trim moulding (outside) + center of clip

Fit clip corresponding to marks



Clip in ornamental moulding



Fit adjusting brackets (repair kit)* in body open hole



20 5 874

Moisten adhesive film in water to facilitate moulding



20 5 874

* Source of supply: BMW Parts Service

20 5 874

Source of supply: BMW Parts Service



By turning the adjusting blocks, 3 different heights can be set in steps of 1.5 mm.

Insert windshield in body aperture with speed seal 51 3 010 and fix in position.

Note

Ornamental trim may sag, and chips can be shifted slightly until moisture evaporates, then adjusting them to the body aperture.

Turn adjusting blocks until the windshield rests evenly.

Let out windshield with special tool 51 3 010. Cut off lugs on clips.

Open cartridge (repair kit)* fill in applicator gun and screw on corresponding nozzle.



Note: use-by* date of cement.



20 9 1 002

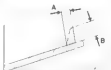
If necessary, produce a sample bead before cementing. The Cartridge must be perpendicular to the windshield.

Apply cement bead with uniform distance feed pulling rate.



Shape of cement bead:

- A = 10 mm
- B = 12 mm



Apply cement bead (7) all round windshield. Maintain distance (A) to edge of windshield (7) A = 5 mm.



* Source of supply: BMW Parts Service



Completely fit windshield with special tool
 51 31 010 and pins in position.
 Ensure even spacing between body and in
 flanking.
 Secure windshield in this position with lateral
 adhesive tape (e.g. Tesa).

Length: 300 mm
 Width: 50 mm



Caution
 Before it hardens, remove residual cement
 with Silca cleaner (removed) 005.
 Do not press windshield back out before it has
 hardened.
 Hardened cement can only be removed by me-
 chanics.

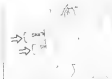


Note
 Leaks can be localized by spraying water
 under the sealing lip or by using an ultrasonic
 leak detection device. The leaks can then be
 sealed off with the aid of a corresponding
 nozzle.

Source of supply: BMW Parts Service

51 31 200 Removing and installing rear window

The same conditions as for the windshield
 apply to the rear window.



Only hot treatment with Silca*ack - Ultraseal
 Before inserting cartridge, it even, grease
 aluminium sleeve of rear end
 Heat cement cartridge to 80°C for one hour in
 oven?



Secure trunk lid to prevent dropping down and
 detach left/right damper



Remove left/right screw



Pull back trunk lid as far as it will go and push

forward



On vehicles as of Feb. 1989 it is no longer possible to push forward the trunk lid. Release bottom and place trunk lid in luggage compartment.

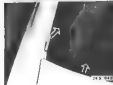
Installation note:
Align and fit trunk lid in position, refer to 41 82 654



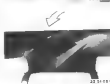
Slide covering to one side and uncouple dimension to frame



Lift out clips and adjust blocks



Unlock left and right C-pillar trim panels to install, disconnect plug connectors from interior lamps and remove C-pillar trim panels by pulling forward.
Disconnect plug connector from heated rear window and antenna



Slightly push down headlining

Mask off trunk lid and body

The further procedure is identical to job instructions 51 31 000

**Installation note**

Securely fit rear window in position with special tool 51 3 040 in conjunction with special tool 51 3 010. Position the suction flaps as far as possible on the outside. Attach positioning hooks (1) at bottom of rear window frame and screws in marked screws (2) until dimension (A) is met between the ornamented trim moulding at the top roof joint and the body. Fasten rear window with self-tapping screws (1) once again and correct (if necessary) the rubber seal at bottom.

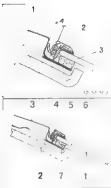
Dimension (A) = 6 mm

**Caution!**

If the rear window was destroyed, glass splinters must be cleaned out of the safety belt automatic-locking retractor.

**NOTE**

Leaks can be detected by spraying water under the sealing lip or by using an ultrasonic non-detection device. The leaks can then be sealed using an appropriate nozzle repair kit.

**Layout of rear window centering point**

- 1 Body
- 2 Headlining
- 3 Rear window

Dimension (A) = 6 mm

- 1 Rear window
- 2 Headlining
- 3 Body
- 4 Ornamented trim frame
- 5 Clip
- 6 Adhesive film
- 7 Cement bead

51 31 300 Removing and installing rear window (fouring)

Open rear window

Unclip panel on left and right and remove adhesive tape

Installation instruction
Secure cable with adhesive tape

Put out rubber grommet and detach plug for rear window heating

Installation instruction
Function test

Unscrew screws on left and right with special tool 51 3 110 and remove rear window



Installation instruction
Fit 1 heating disc on left and right sides between retaining plate and rear window (rear window breakage)
Adjust rear window
Tightening torque*

* Refer to Specifications

51 31 301 Adjust rear window (fouring)

Removing trim for trunk, see 51 48 000

Check, also, that trunk lid is correctly set

Open rear window

Unclip panel on left and right and remove adhesive tape

Installation instruction
Secure cable with adhesive tape

Loosen screws on left and right sides with special tool 51 3 110



Adjust dimension (A) equally on left and right sides

34) 51 041
Dimension (B) underneath approx. 5 mm

Tighten the screws



51 31 200 Removing and installing rear window (lowering)

Open rear window

Unclip finisher on left and right and remove ad-
hesive tape

Installation note

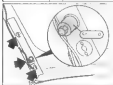
Secure cable with adhesive tape



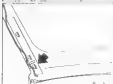
Unfit rubber grommet and disconnect plug
connector for rear window heating

Installation note

Check function



Release screws on left and right with special
tool 51 3 110 and detach rear window



Installation note

Place a heating disk between the retaining
plate and rear window on the left and right
rear window (breakage)

Adjust rear window
For tightening torque 51 31 142

Refer to Technical Data

51 31 201 Adjusting rear window (lowering)

Remove trim panel for trunk lid,
refer to 51 40 000

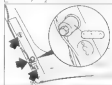
Precondition, trim lid set correctly

Open rear window

Unclip finisher on left and right and remove ad-
hesive tape

Installation note

Secure cable with adhesive tape



Release screws on left and right with special
tool 51 3 110



Adjust dimension (A) evenly on left and right

Dimension (B) at bottom approx. 8 mm

Evenly tighten screws



- Loosen screw (1 - 8)
- Close the trigger window
- The lock pin must be adjusted to correct depth distance
- Tighten screw (1 - 8)
- Tightening torque*
- Check the adjust zone - refer to Group 5)
- Check function



51 31 311 REPLACING TA L GATE WINDOW

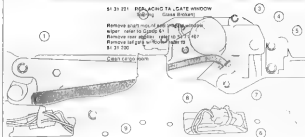
(Refer to Page 51-31 100)

Remove chain mount and wiper - refer to Page 51-31 100

Remove door weather strip - refer to Page 51-31 100

Remove tail gate window

51 31 330



51 31 REPAIRING STONE DAMAGE ON LAMINATED SAFETY GLASS WIND SHIELDS (CLEAR OR TINTED GLASS)

These instructions are meant for skilled workers who are well qualified, with specific knowledge and accept full responsibility for their work. Instructions are limited to factory approved repair materials. Repairing methods as well as anticipated tips to make the work easier. The sections only describe general procedures. The actual scope of work will have to be adapted to the degree of damage. The repair is an economical solution so that optical impairment cannot be excluded. Consequently repairing should only be carried out when ordered by the customer.

Conditions listed below for the repairing of laminated safety glass windshields conform with legislation in Germany. Always conform with legislation valid in other countries.

Important!

Only damage on outside surface of windshields may be repaired inside of window and plastic sheet must not be damaged in any manner whatsoever.

Repairing should be carried out as soon as possible after occurrence of the damage. The presence of moisture or dirt must not be visible in the damaged area.

Repair spot cavities must not exceed a diameter of 5 mm.

Cracks leading away from the impact spot must not be longer than 50 mm. They must not end in the rubber window frame or ornamental strip.

Repairs must only be carried out outside of the field of vision (see sketch). Visibility through the repaired surface must be free, permanent for light and without a shadow as well as possible.

Continue with working instructions!

- A = 145 mm
- B = 190 mm
- C = Limited by edged zone

51 31 Repairing stone chip damage on laminated safety glass windshields (clear or tinted glass)

These repair instructions are intended for qualified skilled workers who work professionally continuously and who accept full responsibility for their work. These repair instructions are restricted to BMW approved materials (DAGBOND®); the repair method as well as related steps to complete the work, is varied. These instructions can only illustrate the general procedure. The actual scope of work should be adapted to suit the extent of damage. The repair constitutes a cost effective and fast solution although the final appearance may be impaired. The repair should be offered to the customer on inspection of for used vehicles and on special customer request.

The conditions listed below for repairing laminated safety glass windshields comply with legislation in Germany.
Always conform with prevailing national legislation.

Caution:

Only damage on outer surface of windshield should be repaired. Inside of window and plastic film between inside glass and outside glass must not be damaged in any way.

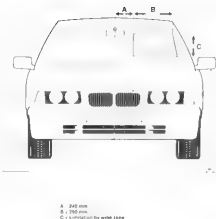
Repairs should be carried out as soon as possible after the damage has occurred. The penetration of moisture or dirt must not be visible on the damaged area.

Impact spot diameter must not exceed a diameter of 5 mm.

Cracks radiating away from the impact spot must not be longer than 50 mm. They must not end in the rubber weatherstrip or in the structural frame frame.

Repairs must only be carried out outside the field of vision (refer to diagram). Visibility through the repaired surface must be clear, transparent and with minimum distortion.

Note handling instructions.





Note
Allow vehicle to stabilize room temperature
(+20 °C) - heat front shield from inside

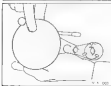


Thinly coat suction cup (1) of concentrating mirror reflector with gel and position suction cup on the windshield from the inside such that the damaged point (3) can be viewed from the outside in the concentrating mirror reflector (2)



Using a marking tool, remove all glass splinters from the impact point working from the outside so that a roughened surface is obtained

Caution
Do not enlarge hole of impact point



Thinly coat suction cup of tool holder with gel



Position tool holder (4) on windshield from the outside so that the opening (5) of the squirrel head (6) is located exactly above the impact point (3)



First turn back knurled screw (7) Move locking lever forward and then back again (suction cup holds firm)



Turn knurled screw (7) until the foot (8) of the squirrel head rests firmly on the windshield, also not screw in too tight, this may cause tension and crack the windshield



Screw cylinder (9) into squirrel head (6) until rubber seal (10) firmly surrounds impact point (7) on the windshield and the foot of squirrel head (8) just begins to lift a little (do not screw in too much, tension can occur, causing the windshield to crack)



Unscrew injector (11) out of cylinder (8), then screw into cylinder (8) from above and check whether rubber seal (10) is positioned centrally above the impact point (2).
Correct position: 1 necessary



Open resin bottles and fill approx. 1/3 of the contents into the cylinder

Caution

Re seal resin bottles immediately after use and protect from UV light



Stir out any air bubbles in the filled resin with a wooden stick



Screw injector (11) up to dimension (A) into the cylinder (slight resistance can be felt) and leave set-up for approx. 5 minutes.
Dimension (A) = 5 mm

Note

A pressure of approx. 15 bar is exerted in this position. While observing the impact point it can be seen that the air at this point disappears slowly (indicated by black shadows)



Checking pressure injector (11) to dimension (B).
Dimension (B) = 12 mm

Note

In this position, a vacuum is now effective which "draws out" the remaining air from the impact point



Once again screw injector (11) into cylinder up to dimension (A) (slight resistance can be felt) and leave everything rest for several minutes.
Dimension (A) = 5 mm



Repeat this alternative pressure-vacuum procedure several times and then leave the injector (11) for a time in an intermediate position between dimension (A) and dimension (B)

Note

If not all air is completely removed, air is applying pressure. Heat up the moldpiece with a lighter for several seconds (not too long, however can occur causing the moldpiece to crack). Hold the flame as close to the glass as possible, but without touching it



Release knurled screw (7), twist squish head (6) to one side and observe the repair point from the top and from various angles in the concentrating-reflector mirror. There should now be no more visible air inclusions. If however, air inclusions are still visible, twist squish head (6) back over the impact point and screw in knurled screw (7) as before. Repeat alternating pressure/vacuum procedure.



Push locking lever forward and remove tool holder from work (steps)



Allow one drop of resin to drip onto the impact point and cover with transparent film.

Note:
Only place transparent film on impact point. Do not press.



Mount UV lamp over repair point and press into position (press suction cups one after the other).
Connect UV lamp and allow resin to harden for approx. 10 minutes.



Remove UV lamp, peel off transparent film and scrape off surplus resin with a razor blade.



Once again allow a drop of resin to drop onto the impact point and cover with a piece of transparent film.



Carefully pass razor blade over transparent film so that surplus resin emerges from the sides.



Once again mount UV lamp over repair point and press down firmly (press suction cups one after the other).
 Compact UV lamp and allow resin to harden for approx. 10 minutes.



Remove UV lamp, peel off transparent film and scrape off surplus resin about the repair point with a razor blade.

Caution!
 Do not scrape over repair point (2)



Polish repair point with a lint-free rag and polish until surface is clean and smooth.

51 32 154 ADJUSTING LEFT OR RIGHT FRONT DOOR WINDOW

Remove front door in its panel see 51 41 000



Note:
Rubber seal must bear uniformly on the door window glass (to prevent wind noise)



Door window must be parallel to the window frame and submerged to an uniform depth in the top window seal



The window can be adjusted parallel to the window frame by adjusting the guide rails

The door window is limited at the top by the adjustable stop

51 32 175 REMOVING AND INSTALLING FRONT DOOR WINDOW GLASS

Remove mirror – see 51 18 000
Remove door inner panel – see
51 41 000

Adjustment
Adjust front door window – see
51 32 154

Lower door window

Caution
Pull off plug on power window motor
in the interest of safety

Pull out retainer from the slide

Disengage window lifting arms in
a slide

Lift out window recess seal and
ornamental grip



Lift out ornamental frame



Lift out rubber guide
Unscrew screws
Lift off plate



Lift out ornamental strip



Pull out window glass from above

Attention
Insert window glass if guides on left
and right sides



51 33 000 REMOVING AND INSTALLING POWER WINDOW REGULATOR IN FRONT DOOR

Remove front door trim panel - see 51 41 265

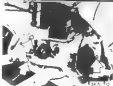
Installation

If necessary, adjust front door window - see 51 32 154

Loosen door window
Lift out microswitch
Pull off plug

Pull out retainer from the side

Disengage window lifting arms in slides



Loosen screws, drill off rivets if applicable
Lift out complete window regulator

Installation

If applicable, replace drilled off rivets with M6 x 10 screws, 6.4 washers and M6 hexagon nuts
Tightening torque = 9 Nm (6.5 ft. lbs.)

Undo screws
Take off gearbox/motor



51 34 154 ADJUSTING REAR DOOR WINDOW

Remove rear door or its panel - see 51 42 000



Note

Rubber seal must bear uniformly on the door window glass (to prevent wind noise)

211 18

Door window glass must be parallel to the window frame and run into the upper window seal uniformly

The window can be adjusted parallel to the mechanical frame by adjusting the guide rails

Door window glass is linked at the top by an adjustable strap



211 130



211 130

51 34 171 REPLACING LEFT OR RIGHT REAR DOOR WINDOW

Remove door trim panel - see
51 42 366

Installation

If necessary, adjust rear door window
- see 51 34 154

Lower door window

Caution:

Pull off plug on power window motor
in the interest of safety

Pull out retainer from the side.

Disengage window. Swing arms - the
bottom

Lift off plates (1 and 2).

Unscrew screws.
Lift off plate

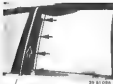
Lift off ornamental grip

Lift off window recess seal

Introduce
if necessary, replace clips

Lift off plate
Pull out window guide





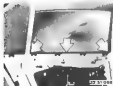
Unscrew screws
Lift off plate



Instruction
Coat rubber seal (1) with a lubricant for
rubber parts
Engage and press down plate



Pull out window glass from frame



Instruction
Insert window glass in guides on the
left and right sides

51-34/4



51-34 101 REPLACING WINDOW GLASS IN LEFT OR RIGHT REAR DOOR WINDOW FRAME

Remove rear door trim panel - see 51-42 000

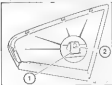
Remove ornamental strip
Lift out ornamental strip on outside



Lift off frame (1)
Lift off glass (2)



Unscrew screws and lift off glass



Note
Clips (1) on the rubber blocks at the window rubber frame have a tab (2) on one side. These tabs of the clips engage in openings in the door frame.



Apply tip of Special Tool 51-3 100 on the edge of the clip from the inside and press in clip firmly. In so doing support the tool on the window at (A) and press out the window glass in this

— Shown/Removed —



Apply the same procedure on the remaining clips and press out the window glass clip by clip.



Installation
Rub in rubber frame with a rubberizer* and fit clips on the rubber frame engage in the openings of the door frame

51 36 070 Removing and installing rear left or right side window (bolting)

Note information on mounting windows, refer to 51 31 31

Remove outer window cavity cover strip, refer to 51 32 240
Remove inner window cavity cover strip, refer to 51 32 261
Remove outer trim finisher on C-pillar, refer to 51 32 365



Completely remove edge protective strip of side window and mask off this area with fabric adhesive tape

Only with side window antenna

Mask off antenna wires with fabric adhesive tape (1) (risk of damage)



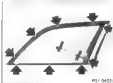
Fit straight knife blade* with adjustable setting roller or tool* and set dimension (2)

Tap from C-pillar to C-pillar
Dimension (3) = 28 mm

Front from top to bottom of C-pillar
Dimension (3) = 30 mm



Carefully insert blade* between body and side window weatherstripping at top of C-pillar
Guide side of knife parallel to side window weatherstripping
Cut through remnant bond as close as possible to body aperture



When cutting, try not to damage the speaker holes on the PVC casing
If they are damaged, the utmost care must be taken during installation



Only hot treatment with SikaTack L-Isotop¹

Before inserting cartridge in oven, preheat aluminum cover at rear and heat solvent cartridge to 80 °C for one hour in cartridge oven

Only LRI side with side window antenna

Disconnect antenna plug connector (1)

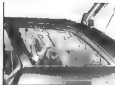
Version: Antisell system with antenna protection

Disconnect plug connector (2)
If necessary, secure cable with cable tie to side window

Source of supply: BMW Parts Service

01/04/2014

¹ Source of supply: BMW Parts Service



Cut through cement bead from top of C-pillar down and then up to the D-pillar.

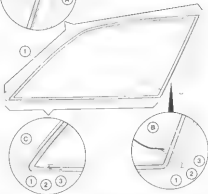


1.11 Cut side window with special tool 51-3-010. Carefully cut through cement bead at the bottom with a scalpel (surgical or flat) or with knife blade* (11 mm long).



Cut off remaining cement in body aperture down to a thickness of approx. 0.5 mm.

Cut off old cement carefully with a general purpose knife (razor sharp) in order to avoid damaging the paint finish in the body aperture.



The remaining cement (if) must be cut off flush all round with the PVC web (2). Height of PVC web (2) with respect to PVC coating all round (without cement) is approx. 0.5 mm.
Height of PVC web (2) to side window (2) is:
(A) top approx. 8 mm
(B) vertically to C-pillar approx. 5.3 mm
(C) bottom approx. 6.4 mm

Caution!

Damaged paint finish must always be repaired to guarantee long-term corrosion protection.
Remove residual cement. Sand out scratches in areas not visible and touch up with BMW EP prime 500 (2 K)*.

Large damaged spots must be ground down to bare metal and coated with BMW EP primer 500 (2 K)* (layer thickness 30 - 40 µm).
The BMW EP primer 500 must be allowed to harden.

(A) Applying cement on existing cement bead

Coat residual cement bead on side window and body aperture with a primer (Gluefix 200)*.
Drying time approx. 1 minute.

(B) Applying cement on PVC coating (only where old cement bead peeled off)

As the result of glasslayer drift in the PVC, the PVC coating on the side window must be treated as follows in the cementing area:

Roughen surface with sanding paper, grain size 200.
Clean twice with 2-propanol (100 % alcohol, available from pharmacies).
Drying time approx. 1 minute.
Apply black primer 500† (Gluefix Base II).
Drying time approx. 10 minutes.

Clean body aperture with 2-propanol.
Drying time approx. 1 minute.

Caution!

The PVC coating on the side window must not be treated with Gluefix Gluecoat 200.



Secure special tool 51-3-010 on outside of window.

Note:

Moisten suction surfaces.

Remove outer window cavity cover strip. For this purpose, place side window in body aperture (without cement) and align.



Cut nozzle to size.

Application on PVC coating

(A) = 8 mm
(B) = 11 - 12 mm

Application on old cement

(A) = 8 mm
(B) = 8 mm

Note:

To apply uniform cement bead, use cartridge (piston) operated with compressed air or electric power†.

Note "Use by" date of cement.

If necessary, adjust the height of the cement bead in the case of height differences of the old cement by varying the application speed.



Fit C-clamp fixture (1) to rearhanging. If necessary, secure antenna wire (2) and wire for interior protection (3) with adhesive tape.

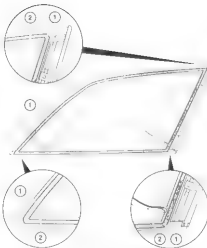
* Source of supply: BMW Parts Service

* Source of supply: BMW Parts Service



Mask off bottom of body aperture with an iso
price 10 mm wide (short) strip of masking tape

If necessary, produce a sample bead before re-
sealing. Cartridge must be perpendicular to
side window.



The cement bead (1) should be started at the bottom rear corner of the window.

Apply cement bead (1) all round side window (in one operation without stopping).
Maintain distance of approx. 1 mm to PVC web (2).
Join bead at joint with wooden spatula.



Using special test (1) (2) (3) place side window in body aperture. fit in position and secure with fabric adhesive tape.
If necessary place polyester plate (1) on bottom trim mounting.

Note
Ensure the side window is aligned flush with the outer trim panel.

Caution*

Before it hardens, remove residual cement with Solignum Cleaner (remover) 20R. When cleaning, do not press side window back out before it has hardened.



Installation note
Connect valve (1) for window antenna.

The back cable (2) cutting across on vehicles without interior protection facility.



Five y tighten screws of Caplugs (hooker) and in caps.

Note
Leakage can be localized by spraying water under the sealing lips or by using an ultrasonic leak detection device*. Leaks can then be sealed with the aid of an appropriate marine repair kit*.



* Source of supply: BMW Parts Service

* Source of supply: BMW Parts Service

51 36 071 Replacing rear left or right side window (fouring)

Note information on mounting windows, refer to 51 31 31

Remove outer window cavity cover strip, refer to 51 37 240

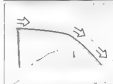
Remove inner window cavity cover strip, refer to 51 37 261

Remove outer trim, trimmer and C pillar, refer to 51 13 565



Completely remove edge protective strip of side windows

Mark off body and outer trim insulating all four side windows

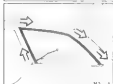


Cut off PVC coating with knife blade (razor sharp) using the trim insulating

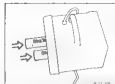


Fill knife blade* (2x mm) long on roof. Carefully insert knife* between body and side window

Guide edge of knife parallel to side window. Cut through cement bead as close as possible to rear window glass



Cut through cement bead



Only left postment with finalTask. Ultimate Before inserting cartridge in oven, place aluminium cover all rear and Heat cement cartridge to 80 °C for one hour in cartridge oven



Only L.H side with side window antenna

Disconnect antenna plug connector (1)

Version, antitheft system with interior protection

Disconnect plug connector (2)

If necessary, secure cable with cable tie to side window

* Source of supply: BMW Parts Service

* Source of supply: BMW Parts Service



Lift out side window at top with special tool
51 3 672 and carefully cut through cement
bed with general purpose knife (pawer sharp).



Cut off remaining cement in body aperture
down to a thickness of approx. 0.5 mm.

Cut off residual cement carefully with a
general purpose knife (power sharp) in order to
avoid damaging the paint finish in the body
aperture.

Caution!

Damaged paint finish must always be repaired to guarantee long-term corrosion protection.

Remove residual cement. Sand out scratches in areas not visible and touch up with BMW EP
prime filler (2 K)*.

Large damaged spots must be ground down to bare metal and coated with BMW EP prime filler
(2 K)* (layer thickness 30 - 40 µm).

The BMW EP prime filler must be allowed to harden.

Clean body flange with 2-propanol (100 % alcohol) (drying time approx. 1 minute).

As the result of plaster over drill in the PVC, the PVC coating on the side window must be treated
as follows in the remaining area:

Roughen surface with sanding paper, grain is ca. 220.

Clean flange with 2-propanol (100 % alcohol, available from pharmacies).

Drying time approx. 1 minute.

Apply black primer 5501 (Dunkelgrün).

Drying time approx. 15 minutes.

Caution!

The PVC coating on the side window must not be treated with Surface Cleaner (20).



If a C-pillar finisher (1) in weathering, it
necessarily secures antenna wire (2) and wire
for internal protection (3) with adhesive tape.

* Source of supply: BMW Parts Service

S1 3 010



Secure special tool S1 3 010 (with joint) on outside of window.
Secure special tool S1 3 010 (without joint) on inside of window.

Note
Mustn't use both axes.

Get new 4 to 6 mm

Application on PVC coating:
(A) = 8 mm
(B) = 11 - 12 mm

Note
To apply pre-form cement based, use cartridge pistol* (operated with compressed air or electric power).

Note
Note 'use by' date of cement!

* only lighter testing, use of Di-pistol (required for retubing after filling inside window)

If necessary, produce a sample bead before cementing. Cartridge must be perpendicular to side window.



1



1

2



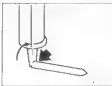
3

1

The cement bead (1) should be started at the bottom rear corner of the window.

Apply cement bead (1) on round side window (in one operation without stopping).
Maximum displacement of approx. 1 mm to PVC web (2).
Join bead at joint with window spatula.

Source of supply: BMW Parts Service





Using special tool SI 3 010, place side window in body openings. Fit in position and secure with fabric adhesive tape.



Secure special tool SI 3 010 (without joint) on inside of window.
Secure tape on tool SI 3 010 (pressing strap) to top of upper or tool SI 3 010 (1).
Attach remaining strap diagonally in bottom using lug and firmly tighten (2).



Tighten left tensioner in center (4) so that the lug is located approx. 400 mm above the floor entry (4).
Tighten top belt tensioner (3) so that lug can be pulled back approx. 20 mm (3).

Caution
Before it hardens, remove residual cement with Shapex Cleaner (remover 200). When cleaning, do not press tape window back out before it has hardened.



Fit ring lighter screws of Capilar fastener and fit tape.



Hint
Leaks can be localized by spraying water under the existing tape or by using an ultrasonic leak detection device*. Leaks can then be sealed with the aid of an appropriate repair (repair kit).



Precaution note
Connect valve (1) for window antenna.

The back cable (2) (antenna cable) on vehicles without a sensor protection facility.



51 37 000 REMOVING AND INSTALLING POWER WINDOW REGULA- TOR IN LEFT OR RIGHT SIDE WINDOW

Lower door window
Remove rear door trim panel - see
51 42 000

Installation
Adjust rear door window - see
51 34 020

Pull off clip
Lift out interconnect
Disconnect plug

Pull out regulator from the side

Disengage window lifting arms in the
sides



Unscrew screws, drill off rivets if
applicable
Remove complete window regulator

Installation
If applicable, replace drilled off rivets
with M 5 x 16 hexagon heads screws,
5 4 washers and M 5 hexagon nuts.
Tightening torque : 9 Nm (6.5 ft. lb)

Unscrew screws
Remove gearbox, if prior



51 37 240 REMOVED AND REINSTALLED
REPLACING WINDOW RECESS
STRIP ON OUTSIDE OF LEFT
OR RIGHT REAR SIDE WIND-
OW, Four up

Note:

Ornamental clips are cemented on side
windows of cars produced up to May June
of 1952 and on replacement side windows
produced up to September of 1953

Cemented Strips

Cover painted surface below strip with
adhesive tape.
Press out strip at rear top slightly using a
brush and cut through cement on strip
using a standard knife (strip as rear
blade)

Cut all loose on PVC sprayed on rear side
window but to about 1 mm

Refer to 51 31 for information on
reglazing windows

Clean surface and sprayed PVC coat with
primer* and air dry about 10 minutes

Apply window cement to strip opposite the
securing beads

Press on and strip strip

Place a wooden block on each end of the
securing beads and clamp down with ad-
hesive tape.
Hardening time at least 4 hours

Cropped Strips

Prior to reinserting, ensure that strip is not
cemented by carefully lifting the rear end of
the strip using a spreader

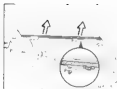
Unclip strip from rear to front and using a
cutter

* Caution

Clips must be centered and must not be
damaged.
If applicable replace damaged clips

51 37 361 REPLACE WINDOW RECESS
STRIP ON INSIDE OF LEFT OR
RIGHT REAR SIDE WINDOW
(Triming)

Remove cargo room wheel house trim
panel - refer to 51 42 101 or 51 42 161



Put off gunwale strip

Trim, if

Ensure that strip snaps into clips correctly



51 41 300 REMOVING AND INSTALLING LEFT OR RIGHT FRONT DOOR TRIM PANEL

Pull the outside mirror adjusting knob off. Remove the mirror switch using Special Tool 51 1 300 and disconnect the plug.

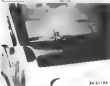


51 41 3

Unscrew screw



Remove the screw cover. Unscrew screw and pull the spacer necks past out.



51 41 34

Unscrew the catch button.



Lift the plate out. Unscrew screw and remove the window winder.



51 41 120

Installation
Install the window winder with the window closed as shown.



51 41 100

Unclip the trim panel.

Important!
Unclip each clip separately.

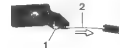
Lift the trim panel out towards the rear.

Installation
Replace damaged clips.

1 = Cable core
2 = Cable sleeve

Pull the cable sleeve back and disconnect the cable core.

Installation
Check for correct seating of the cable.



51 41 82



Squeeze locking hook (2) with a pliers and pull off clamp (1)

Installation

Insert clamp (1) in holder (2) on the door trim panel.

Important

Note the direction of insertion.



Installation

Check the butyl bond prior to installation of the trim panel, replacing if necessary.



51-42-100 REMOVING AND INSTALLING LEFT OR RIGHT REAR DOOR TRIM PANEL

Lift out power window switch.
Pull off plug.



Lift out plates.
Unscrew catch button.



Unscrew screws.



Lift off plate.
Unscrew screw and take off window winder.



Installation
Mount window winder as shown with the window closed (raised).

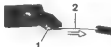


Unclip trim panel.

Important
Unclip each clip separately.

Lift out trim panel from above.

Installation
Replace damaged clips.



1 = Cable core
2 = Cable sleeve

Pull back cable sleeve and disconnect cable core.

Installation
Check that cable sleeve seats correctly.



Squeeze locking hook (2) with a pliers and pull off clamp (1).



Installation

Insert clamp (1) in holder (2) on the door trim panel.

Important!

Note the direction of insertion



Installation

Check bulb seating, repeating if necessary, prior to installation of the trim panel



51-43/22 REPLACING TRIM PANEL FOR LEFT OR RIGHT REAR ROOF PILLAR (D-PILLAR)

Unclip (1) the side trim panel, hold it up and take it out (2). Unscrew screws.



Remove plate



Unscrew screws and remove dust/flange.



Unclip the D-pillar trim panel at top and remove it.



51 44 011 Removing and installing or replacing complete head-lining (sunroof version)

Remove sun visors and support brackets on left and right.
If necessary, disconnect plug connector for mirror light.

Unclip panel, pull down and disconnect plug



Unclip interior lights and disconnect plug



Partly remove edge guard strip on left and right in front door, rear door and at rear side window

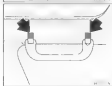
Note

If edge guard strip is fitted too loosely in area of G-pillar fit a approx. 250 mm long strip of (fabric) adhesive tape over the body flange.

If necessary remove holder for net partition



Unclip G-pillar trim panels on left and right.



Unclip trimpanels, release screws and remove all grab handles

Completely remove edge guard strip from sun-roof

Remove front section of headlining



Partly unclip G-pillar and G-pillar trim panel at top



Unscrew rear inside light at left and right, and disconnect plugs.
If applicable, remove holders for network outputs at left and right hand sides.



Caution!
Unclip carefully to avoid damaging built-in rear cassette.

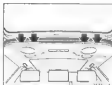
Unclip and remove left and right rear side sections.



Remove left and right rears.



Press down on rear inner rear section slightly and unclip.



If applicable, unclip left and right rear speaker covers.



Unscrew left and right screens.
Unclip display film panels partially and remove rear inner rear section.



**51 44 041 REMOVING AND INSTALLING
REPLACING ROOF LINER
FRONT SECT ION
(Variable with Sun Roofs)**

Unscrew the left and right sun visors and handles.
If applicable, disconnect the plug of the
inside light for the mirror.



Unclip the cover downwards and disconnect
the plug.



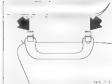
Unclip the inside light and disconnect the
plug.



Pull the edge guards off partially in the
front door openings.



Unclip the left and right A-pillar trim panels.



Unclip covers, unscrew screws and
remove the left and right grab handles.



Pull the edge guard off partially and remove
the roof liner front section.

**51 44 042 REMOVING AND INSTALLING -
REPLACING LEFT OR RIGHT
ROOF LINER SIDE SECTION
(Variant with Sun Roof)**



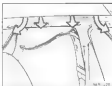
Pull off edge guards partially in front and rear door openings, as well as on rear side windows.
If applicable, remove ladder for network cabinet.



Unclip B and C pillar trim panels at top partially.



Unclip covers, unscrew screws and remove grab handles.
Unclip inside lights and disconnect plug.

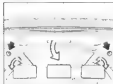


Pull off edge guards partially.



Caution!
Unclip carefully to avoid damaging the sun roof cassette.

Unclip and remove roof liner side section.



51-44 043 REMOVING AND INSTALLING REPLACING ROOF LINER

(Version with Sun Roof)

Unclip rear inside lights at left and right and disconnect plugs.
If applicable, remove holders for rearview mirrors at left and right-hand sides.



Press down on the roof liner rear section slightly and unclip.



If applicable, unclip left and right rear speaker covers.



Loosen edge guard partially.
Pull edge guards off on C-pillar trim panels and rear side windows partially.

Unclip left and right C-pillar trim panels partially.



Caution!
Unclip carefully to avoid damaging the sun roof cassette.

Unclip rear roof liner section at left and right sides partially.



Press down on the rear of the roof liner side section slightly and remove roof.



Unclasp left and right screens.
Unclip D-pillar trim panel partially and remove roof liner rear section.

51-45-000 REMOVING AND INSTALLING DASHBOARD TRIM PANEL

Remove center console - see 51-18-200
Remove glove box - see 51-18-300
Remove instrument cluster - see 52-61-000



Unsnap screws on left and right sides.



Unsnap screws.
Remove trim panel.
If applicable, disconnect plug for radio speaker.



Unsnap screws on left and right sides.



Pull off rubber seals for left and right doors carefully.



Disconnect plug.



Left trim panel off of left and right A pillars.



Disconnect wire connector.



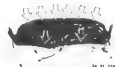
Disconnect wire connector.
Pull off plug.



Unscrew screws.
If applicable, pull off plug.



Left side dashboard
installation.
Check for correct seating of mounting
clips on body.
Align instrument panel.



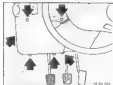
Unscrew screws.
Remove air ducts.



Unscrew screws.
Left side air grill.



Disconnect wire connector.
Remove wing fasteners.



51-45 180. REMOVING AND INSTALLING DASHBOARD TRIM PANEL AT BOTTOM LEFT

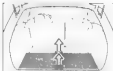
1. Plug plug
Uncover screws



Lift off trim panel



Uncover screws
Lift off trim panel



51 47 151 REMOVING AND INSTALLING REPLACING LEFT REAR HOUSE TRIM PANEL IN CARGO ROOM

Remove the front and rear bulkheads
Remove the interior divider



Unlock (1) the side trim panel, hold it open and remove it (2)



Unlock (1) the grille and remove the grille upwards

Caution:
Clip the grille correctly



Lift (1) the backrest side section out and remove it upwards (2)



Pull the edge guard off of the rear door partially



Unlock the C-pillar trim panel



Unscrew screws and unlock the cover for the automatic seat belt reel.
Take the belt strap out



Lift the securing plugs out
Lift the covers off of the escutcheon



Unscrew screws.
Lift the edgeguard out and remove the
side trim panel.



51-47-185 REMOVING AND INSTALLING REPLACING RIGHT WHEEL HOUSE TRIM PANEL IN CARGO ROOM

Remove the front and rear bulk covers.
Remove the interior divider.



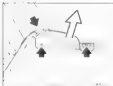
Unhook (1) the side trim panel, fold it down
and remove it (2).



Put the edge guard off partially
uncouple and remove the C-pillar trim panel.



Lift (1) the backrest side section out and
remove it upwards (2).



Unscrew screws and unclip the cover for the automatic seat belt reel.
Take the belt strap out.



Unscrew screws and remove the grill upwards.

Installation
Clip the grill in correctly.



Let the securing plug out.
Let the covers off of the escutcheon.



Unscrew screws.
Let the escutcheon out and remove the side trim panel.

51 49 000 REMOVING AND INSTALLING REPLACING TRIM PANEL FOR TAILGATE

Undo clip on screws.

Undo clip on screws.

Unscrew screws.

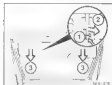
Open the toolbox.

Push (1) the latch and lift (2) the receiving strip out.
Remove the toolbox downwards (3).

Remove clips.

Unscrew left and right screws.

Unscrew screws.
Unscrew screws of handle recess plate.

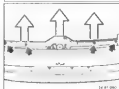




Slide the wiper gate.
Unscrew the cap on the wiper crank.



Push gate screen



Push wiper panel out of the slope carefully.
Remove the wiper panel.



51-71 000 REMOVE DOOR SEAL AND RESEAL, LHC
REPLACING SEAL, ON LEFT
OR RIGHT REAR DOOR

Lift out door splasher and, if necessary
cover

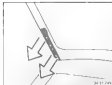


Lift out plates

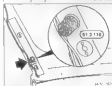


Pull out seal carefully
If necessary clean cementing surface with
gasoline

Other steps are identical with those
described in 51-71 000



51-71 000



51-71 000



51-71 000



51-71 000

51-71 457 REPLACING REAR SPOILER
(Touring)

Open tailgate window
Unscrew panels on left and right hand sides
and pull off adhesive tape.

Installation
Secure wires with adhesive tape.

Unscrew screws on left and right hand plates
using Special Tool 51-2 110.

Push wiring (1) out of spacer (2).

Cut through cement bead with a straight
cutting knife
Cut outside with knife only up to (A)
(corner).

Distance A = 40 mm.



Note information on mounting windows, refer to 51 31

Remove cement residue on rear window
Clean rear window and spoiler and coat oil-mounting surface with primer (paper kit)*

Note

Drying time approx. 10 minutes

Only Fast treatment with BituTack, without

Before inserting cartridge in oven, please aluminium cover all tape and heat cement cartridge to 80 °C for one hour in oven

Cut boards to size

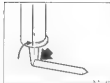
Dimensions

(A) = 8 - 7 mm

(B) = 5 - 6 mm

Note

To apply uniform cement bead, use cartridge prior (operated with compressed air or pump) into primer



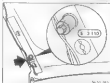
51 31 100

If necessary, produce a sample bead before cementing.
Cartridge must be perpendicular to rear window



51 31 100

Apply cement bead (1) in grooves of spoiler
Press grout (2) into screws on left and right



51 31 100

Fit spoiler on rear window (press down, align and firmly tighten with special tool 51 31 110)

For tightening torque, refer to Technician Guide 51 71 242

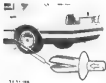


51 31 100

Remove rear spoiler (1) with wooden blocks and fabric adhesive tape (2)

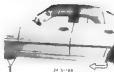
For hardening time, refer to 51 31 100 table of minimum hardening times

* Source of supply: BMW Parts Service



51 71 417 REMOVING AND INSTALLING PANEL FOR COVER ON LEFT OR RIGHT SIDE

Remove rear wheel – see Group 38
 Knock out plug (1) in the expander rivet
 Pull out expander rivet

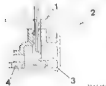


Unscrew screws (7).
 Pull panel out of clips from behind



Squeeze clamping parts on the sides
 in the clamps with a circlip pliers and
 pull out

Installation
 Replace damaged expander rivets
 clamps and clips



Installation
 Check for correct seating of clamps
 and clamping parts

- 1 Sheet metal fold on side member
- 2 Panel (plastic)
- 3 Clamp
- 4 Clamping part

Installation
 Squeeze clamping part and clamp on
 the sheet metal fold with a pliers



52 Seats

52 0	General information	52-	0/1
52 10 000	Front seat, left or right - remove and install	52-	10/1
	Front seat, left or right - disassemble and assemble (seat removed)	52-	10/2
	Front power seat, left or right - disassemble and assemble (seat removed)	52-	10/4
	Seat rails and drives	52-	10/5
205	Armrest on front seat - remove and install	52-	10/8
52 11 501	Covers for left or right front seat - replace	52-	11/1
52 20 000	Rear seat cushion and backrest - remove and install	52-	20/1
	Rear seat center armrest - remove and install (M5)	52-	20/2
	Load-through mechanism	52-	20/3
	Split rear seat cushion and backrests - remove and install	52-	20/4
070	Rear seat backrest, left or right (touring) - remove and install or replace	52-	20/6
075	Rear seat backrest side section - left or right (touring) - remove and install or replace	52-	20/8

52-0 GENERAL INFORMATION

Power Seats

Troubleshooting refer to Car Electric/Electronic Test Plan 52-05

Caution

The seat belt with pretensioner must not be deactivated before removing this type of front seat. refer to Group 12

52 10 000 REMOVING AND INSTALLING LEFT OR RIGHT FRONT SEAT

Caution

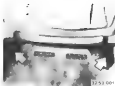
Disconnect seat belt lock tensioner - refer to Group 72



52 10 000

Run seat up to "high" position.
Disconnect cable for seat belt height adjustment.
Unscrew seat belt.

Illustration
Tightening torque*



52 53 001

Unscrew bolts - if necessary, run seat for

illustration
Tightening torque*

Pull out headrest with one jerk.



54 00 001

Let rear end of seat and slide seat forward out of the front brackets (A).
If applicable, disconnect plugs.



52 60 000

Reop

A power seat can be adjusted manually in forward/back direction with help of a screw driver (A run while seated) in case of power control failure



52 50 004

Insert screwdriver into hole of potentiometer or adjuster and turn until the bolts are accessible.

* Refer to Specifications

* Refer to Specifications

52 10 DISASSEMBLING AND ASSEMBLING FRONT SEAT

Unclip and withdraw trim panels on left and right sides with Special Tool 52 1 100. Operate all levers to move all springs into final position.

Seat Back
Disconnect cable

Insert Special Tool 52 1 100 at retaining pins. Shown and close them out.

Installation
Pins must be replaced.
Drive on pins against stop with Special Tool 52 1 100.
Check whether retaining (1) engages and that Hook (2) are not damaged.

Push up trim panel, pull out of slot at bottom and remove.
Remove headrest with care pins.

Press down levers on left and right sides with a pin and pull up (backward).

Seat Cushion
Uncover levers.
Take off seat cushion cover.

Uncover console

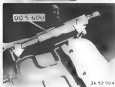
52-10/3



Note
Reattach spring with setting.



Pull left suspension
Take off gas pressure spring



Installation
Connect gas pressure spring with Special
Tool 00 5-840 and secure with new
retainers



52 10 DISASSEMBLING AND ACCESSING FRONT POWER S.A.U.T
Screw Removed

Step 10a
Unclip and unscrew cover panels on left and right sides with Special Tool 52 2 100.



Unscrew control unit – pull off plug
Inspection:
Plug connections are coded
Control unit bolts in rubber mounts (1)



Guide Special Tool 52 1 100 into bearing area (four) and drive them out.



Installation
Pins must be replaced
Drive on pins against stop with Special Tool 52 1 100.
Check whether retainers (1) engage and that stops (2) are not damaged



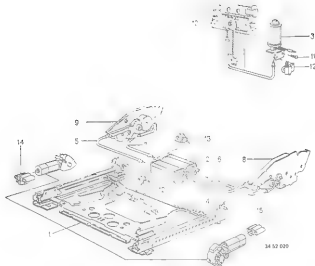
Drill out rivets remove plate.



Unscrew motor (front wash height)
Unscrew bolts take off rails
Inspection
Lubricate pin wheel with grease



Inspection
Same distance (A) on left and right rails and toothed element (1) in same position.
Lubricate splines with grease
Install covers (2)



- 1 Seat rails with drives
- 2 Up/down seat drive
- 3 Drive
- 4 Up/down seat drive shaft, left
- 5 Up/down seat drive shaft, right
- 6 Backrest drive shaft, left
- 7 Backrest drive shaft, right
- 8 Gearbox, left
- 9 Gearbox, right
- 10 Headrest gearbox
- 11 Oval head screw
- 12 Headrest and up/down seat drive regulator
- 13 Backrest drive regulator
- 14 Forward/back seat drive regulator
- 15 Seat inclination drive regulator



23 02 013



24 02 013



25 02 013



26 02 013

Unseal motor (forward/back)

Any lubrication

Lubricate splines with grease

Connect spring before tightening the nuts



28 02 013



29 02 013

Unseal motor

Backrest

Push up backrest in in panel and pull it out of clips at bottom.

Unseal potentiometer

Pull off plug and disconnect leads or

Unseal

Press down levers on left and right side

with a pin - take off backrest

Disassembly

Connect plugs/leads that colors match

Pull out headrest

Unseal cover partially

Unseal belts - take off gearbox

Drive shaft is connected permanently on the gearbox



Seat

Loosen seat cover partially.
Unscrew bolts and pull shaft out of back restrest.

WARNING:

Position of backrest and seat height same on left and right sides. Double by turning shafts if necessary.



20 52 000

Unscrew screws.

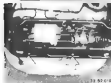
Left seat back up.

Remove backrest 1 in fig.



WARNING:

Lubricate splines with grease
Insert screws (1).



20 52 000

Unscrew motors.



20 52 000

Notes

- 1 Motor for backrest with black plug and potentiometer 1 376 006 9
- 2 Motor for seat up/down with white plug and potentiometer 1 376 004 9



52 10 006 REMOVING AND INSTALLING ARMREST ON FRONT SEAT

Push up trim panel, pull out of clips at
bottom and re-strap.



Unhook from back of seat (pull up)



52 11 501 REPLACING SEAT CUSHION COVER FOR LEFT OR RIGHT FRONT SEAT

Seat (Removal) Section: Taken Off at Seat

Seat Cushion

Bend hooks to unlock, and if necessary cover Q-connect removing string (A) and take off cover

Bend open top fasteners for cushion and separate cover from the padding



Connect cover at hooks with uniform tightness and without folds (beginning at the front) Bend hooks to lock



Secure cover on seat frame with the string under tight tension

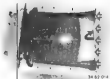
52 007

Install new cover (both together with clips and Special Tool 52 0 050 on the padding (other side)

52 0 050

Install cover on both sides with clips and Special Tool 52 0 050 on the padding (other side)

52 0 050



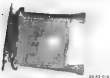
52-11/2-1

Band open all hooks and disconnect cover



52-11/2-2

Band open all clips which connect the cover on the frame (see gloves for example)



52-11/2-3

Band open all clips.
Separate cover from padding.

52-11/2-4



Pull new cover over padding and clip
Secure cover on padding (step) with clips
and Special Tool 52-11/2-5, beginning at the top



If applicable transfer covers.



Secure padding and retracting tongue (1) on the frame with clips

Connect cover on hooks with uniform tension and without folds, beginning at top
Band hooks to rest



52 20 999 REMOVING AND INSTALLING REAR SEAT CUSHION AND

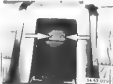
Pull up seat cushion out of clips (1).
Pull out headrest from above.

Fold down center armrest.
Unscrew nuts (2).
Lift out seat belt strap covers (3).
Pull up backrest out of holders.

M 5
Pull separate seats out of clips (1) as
shown.
Pull up headrest to remove.



Turn retainers 90.
Lift out cover from above.



Open console (middle).
Compress tabs.
Remove console.

Lift out seat belt strap covers (3).
Unscrew nuts (2) and lift backrest out
of holders from above.





52 20 REMOVING AND INSTALLING REAR SEAT CENTER ARMREST (M 5)

Open console (middle)
Compress tabs and remove console



Put up separate seat cushions out of
cups (!)



Unscrew screws on left and right sides.
Remove cover from above



Unscrew screws on left and right sides.
Take out drawer.

CARGO ROOM CONVERSION SYSTEM



52 20 REMOVING AND INSTALLING SPLIT REAR SEAT CUSHION AND BACKREST

Lift rear seat cushion on the pulling strap and tilt it forward.

NOTE
Position front side forward slightly if

Compress both unlocking levers and lift out seat cushion forward.

The rear seat backrest is unlocked automatically and can be tilted forward.

NOTE
If locked unintentionally, press the lever - releasing the lever will unlock.

Tilt the rear seat backrest forward, unlock retainers with a screwdriver and lift out the backrest.



24 52 01



24 52 02

Removing Seat Belt Lock.
Unscrew cover on backrest.
Unscrew cover on rear wall.



24 52 03

Lift out seat belt lock cover.
Lift out seat belt lock from groove.
Disconnect cable on the front.

Installation
Adjust cable in such a manner that the backrest is unlocked after pressing down and releasing the unlocking lever.



Note
Unlocking the Seat Backrest in Case of
Failure
Take off top seat belt cover and press
down on lever with a screwdriver

Picture was taken on a removed seat
backrest with its rear wall taken off



**52 20 570 REMOVING AND INSTALLING
REPLACING COMPLETE LEFT
OR RIGHT REAR SEAT BACK
REST (Touting)**

Remove rear seat backrest side section
refer to 52 20 575.
Fold both backrests forward.
Remove the plate between the backrests
upwards.



Left Backrest

Unscrew screw on outside

Installation:
Insert the screw with Locite®¹
Tightening torque²



Right Backrest

Unscrew screw on outside

Installation:
Insert the screw with Locite®¹
Tightening torque²



Push the back back and remove the back
rest upwards.

¹ Refer to Specifications
² Source of Supply: BMW Parts



**52 20 575 REMOVING AND INSTALLING
REPLACING LEFT OR RIGHT
REAR SEAT BACKREST SIDE
SECTION (Touting)**

Left Backrest Side Section

Left (1) backrest side section out and
remove upwards (2).



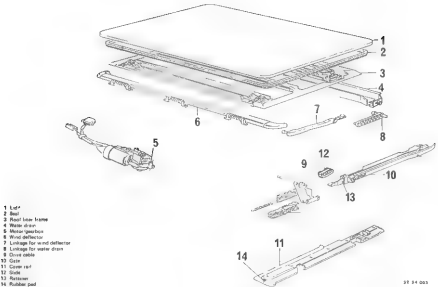
Right Backrest Side Section

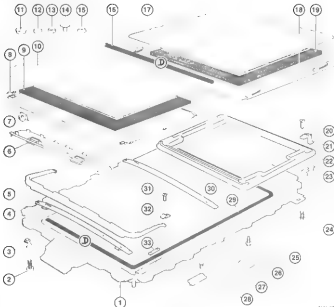
Left (1) backrest side section out and
remove upwards (2).

54 Hood, sunroof

	Arrangement of slide/tilt sunroof	54-	0/1
54 0	Arrangement of double slide/tilt sunroof	54	0/2
	Function description of double slide/tilt sunroof (touring)	54-	0/4
	Emergency closing mechanism - slide/tilt sunroof (touring)	54-	0/5
	Installation of slide/tilt sunroof (touring)	54	0/6
	Operating logic of slide/tilt sunroof (touring)	54-	0/7
	Notes on the repair of cemented gaskets on slide/tilt sunroof	54-	0/9
54 12 004	Slide/tilt sunroof - adjust	54-	12/1
005	Slide/tilt sunroof lid (touring) - adjust at front	54-	12/2
006	Slide/tilt sunroof lid (touring) - adjust at back	54-	12/2
100	Slide/tilt sunroof lid - remove and install	54-	12/3
102	Slide/tilt sunroof lid (touring) - remove and install at front	54-	12/4
103	Slide/tilt sunroof lid (touring) - replace at front	54-	12/4
104	Slide/tilt sunroof lid (touring) - replace at back	54-	12/5
106	Slide/tilt sunroof lid (touring) - remove and install at back	54-	12/6
120	Gasket on slide/tilt sunroof lid - replace	54-	12/7
121	Gasket for slide/tilt sunroof lid (touring) - replace at front	54-	12/7
122	Gasket on slide/tilt aperture (touring) - replace	54-	12/8
132	Headlining for slide/tilt sunroof lid (touring) - remove and install or replace at front	54-	12/8
133	Headlining for slide/tilt sunroof lid (touring) - remove and install or replace at back	54-	12/9
210	Slide/tilt sunroof (frame -touring), complete unit - remove and install	54-	12/10
230	Gearbox (manual) for slide/tilt sunroof - remove and install or replace	54-	12/12
241	Both drive cables for slide/tilt sunroof actuation - replace	54-	12/13
245	Both drive cables at front for slide/tilt sunroof actuation - remove and install/replace	54-	12/14
248	Both drive cables at back for slide/tilt sunroof actuation - remove and install/replace	54-	12/15
255	Both actuating units / actuators - replace	54-	12/15
496	Wind deflector (touring) - remove and install/replace	54	12/16
512	Microswitch (reversing type) for slide/tilt sunroof motor - replace	54-	12/17
54 13 005	Coupling on gearbox unit (touring) at front - remove and install/replace	54-	13/1
006	Coupling on gearbox unit (touring) at back - remove and install/replace	54-	13/1
010	Motor and gearbox for slide/tilt sunroof actuation - remove and install	54-	13/2
011	Motor for slide/tilt sunroof actuation (touring) at front - remove and install or replace	54-	13/2
012	Motor for slide/tilt sunroof (touring) at back - remove and install	54-	13/3
015	Module for slide/tilt sunroof (touring) at back - remove and install or replace	54-	13/3
	Slide/tilt sunroof - troubleshooting	54-	90/1

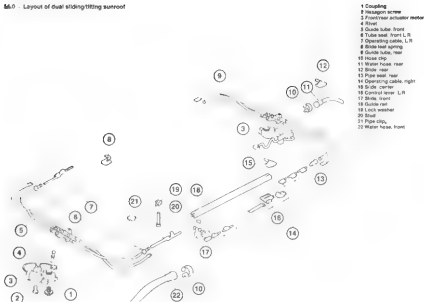
SUN ROOF LAYOUT DRAWING





1. Frame lower section
2. Screw
3. Nut clip
4. Front cross member
5. Wind deflector
6. Plate
7. Retainer
8. Front roof liner frame
9. Front soundproofing sheet
10. Front lid
11. Center top molded washer (hardtop status)
12. Lid washer
13. Center top nut (overtop status)
14. Center top screw (overtop status)
15. Center lid nut
16. Front lid screw
17. Rear lid
18. Rear roof liner frame
19. Rear soundproofing sheet
20. Oval head screw
21. Clamp
22. Lid isomer
23. Retainer
24. Oval head screw
25. Sealing screw
26. Slide
27. Counterbore screw
28. Cover
29. Sun roof opening area
30. Cross member
31. Oval head screw
32. Wind deflector holder
33. Insulated plate

M.O. - Layout of dual sliding/lifting sunroof



- 1 Coupling
- 2 Hexagon screw
- 3 Front/rear actuator motor
- 4 Rivet
- 5 Guide tube, front
- 6 Tube seal, front L, R
- 7 Operating cable, L, R
- 8 Slide seal spring
- 9 Guide tube, rear
- 10 Hose clip
- 11 Water hose, rear
- 12 Slide, rear
- 13 Pipe seal, rear
- 14 Operating cable, right
- 15 Slide, center
- 16 Control lever, L, R
- 17 Slide, front
- 18 Guide rail
- 19 Lock washer
- 20 Sluut
- 21 Pipe clip
- 22 Water hose, front

54 0 Functional description, dual sliding/tilting sunroof, touring

The dual 35 lld sunroof has diagnostic capabilities.

a Control logic (one-touch function)

The following sunroof cover positions can be set automatically by briefly pressing (one-touch) the control switch:

- front vent position (tilt and position)
- front and position open
- rear and position open (block)
- sunroof ventilation (both sunroof covers open (tilt & center)
- convenient close from any cover position

When taking up the 4 cover positions (also convenient closing) the selected function can be stopped into the one-touch function or by pressing up the button.

All positions can be set manually.

a Trap guard (finger guard)

The trap guard is active:

- during convenient closing via control switch or door switch
- one-touch close function for front and rear cover
- parker shift forward or back

The trap guard is not active:

- 4 mm before and position
- during automatic one-touch open function
- during initialization
- during manual opening and closing
- closing the vent position (front tilt position)

a Emergency closing (mechanical)

Because the electrical drive fail the sliding-tilting sunroof can be closed mechanically with a hand crank (passenger seatbelt switch is in front panel of control switch).

Warning

The sliding-tilting sunroof must be initialized after repair.

a Consumer load cutout

All sliding-tilting control functions are interrupted during the starter procedure. On completion of the start procedure, the interrupted functions are not continued.

a Initialization

Initialization is necessary after emergency operation, completed repairs on the sliding-tilting sunroof or after a break in the power supply. Initialization is carried out in absolute zero position (both sunroof/covers closed against mechanical limit stop and headlining frame, duration approx. 20 seconds).

Caution:

The trap guard is not active during initialization and no automatic one-touch function can be carried out.

a Convenient closing

Convenient closing via door lock

Initially, all windows are closed with electric window regulators.

The sliding-tilting sunroof is slowly closed from any position for as long as the key is turned in the "lock and alarm" position.

Convenient closing via control switch

The sliding-tilting sunroof is closed from any position when the control switch is briefly pressed upward.

54.9 Emergency (MANUAL) CLOSING SUN ROOF (tinting)

Sun roof lid can be closed by hand if the electric drive fails.

Preparation

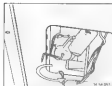
After working on the sun roof installation must be carried out - refer to 54.00 . . .



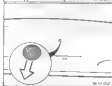
Remove panel



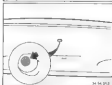
Unscrew screw (1) and pull out clutch (2) downwards.



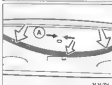
Insert manual winder (hexagon socket key) and turn (drehen/drehen) to close front lid (until RN position is reached).



Remove rear plug downwards.



Unscrew screw



Pull off edge guard partially, plug diameter is 4 (A).

Diameter (A) is 30 mm



Remove coupling (1) by pulling downward. If necessary with the aid of the crank handle of the hexagon crank.



Fit hand crank (1) for hexagon socket screw) and close rear sunroof cover by turning in counterclockwise direction.

54-0 ... Initializing sliding/tilting sunroof, touring

Initialization is necessary on completion of repairs, after emergency sunroof operation or after an interruption in the power supply. Initialization is carried out in absolute zero position (both covers against mechanical limit stop).

Caution!

The trap guard is not active during initialization. Risk of jamming.

The one-touch function is not active during initialization.



Operation:

- (A) briefly press
- (B) press permanently
- (C) close permanently
- (D) sequence of (A) and (B)



Completely close sliding/tilting sunroof.

When both sunroof covers and headliner frame are closed, continue to press close for a further 20 seconds. Initialization is now completed.

- A** 
- B** 
- C** 
- D** 1,2,3

54 0 5 54 IN ROOF OPERATING LOGIC (Touring)

Operation Explanations

- A: Brief tilting (automatic tip operation)
 B: Constant pressing (manual operation)
 C: Movement of lids
 D: Sequence of A and B

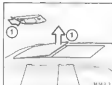
Note

All of the lid positions described below can also be operated manually (B) until the desired position is reached.
 All tip operations can also be stopped by flipping the selected operation a second time or flipping upwards.

Both lids can be closed completely from any position (comfort closing).

Note

Comfort protection is active during comfort closing and is switched off 4 mm before reaching final position (neutral).

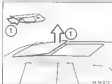


Front Lid in Park Position (Final Lift Position)

- 1: Final lift position (can also be operated from the other side - see next picture)



- 1: Final lift position

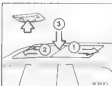


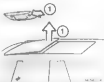
Open Front Lid (Final Position)

- 1: Final lift position



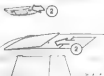
- 2: Open front lid (final position)



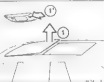


Open Rear Lid (Final Position, Product Closed)

- 1 Place lid position

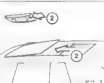


- 2 Open rear lid (final position)

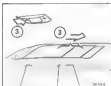


Common Warning (Both Lids Open)

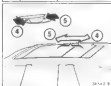
- 1 Place lid so that lid position



- 2 Open rear lid (final position)



- 3 Open both side to block (final position)



- 4 Move block towards rear (variable)
- 5 Move block towards front (variable)

54-5 INSTRUCTIONS FOR REPAIRING CEMENTED GLASS ON SUN ROOF

1 Types of Damage

1.1 Partially Loosened Seals

- Up to 100 mm repaired by hand
- Up to 200 mm repaired with pressing-on tools on straight surfaces

1.2 More Serious Damage (Mechanical Injuries, Largely Loosened Seals)

2 Possible Repairs

- Partially loosened seals consisting of rubber adhesive tape or adhesive tape-glass cemented joints can be resealed with cyanoacrylate cement (Loctite Ar 300)

Precautions

a) Clean damaged surfaces

- Remove grease and other residues from the cemented surface
- Use cotton or lint-free paper towels (one-time use)

b) If solvents are used, let dry the repair surface at least 2 minutes

c) Apply a very thin bead of cyanoacrylate cement on the adhesive tape using a fine nozzle

- Avoid contact on glass
- Do not smear cement on visible painted surfaces

d) Press on rubber seal (Pressing-on time at least 30 seconds. Only contact pressure is necessary, which must be maintained for the 30 seconds. The cement can be subjected to loads only after 2 minutes. This waiting time is absolutely essential.)

- Complete replacement of the rubber seal is necessary in case of a largely loosened seal and/or damaged rubber profile - refer to 3.4.12.121 and 3.4.12.122

Procedures

a) Peeling off damaged rubber seal

- Peel off rubber seal slowly at an angle of 15 to 35°, ensuring that the glue bond between adhesive tape and glass is maintained
- If the rubber itself has become loose, peel the adhesive tape off at the roof opening edges and/or id carefully and slowly at an angle of 15 to 35°
- If necessary, peel off under seals with help of a hot air blower (don't damage the paint finish), whereby the rubber seal adhesive tape bond should not be separated

- Put liner (protective film on adhesive surface) off of rubber seal section by section
- Take hold on tab

- Apply rubber seal on roof opening edge beginning at rear center. Use upper lip as application edge. Press on seal continuously by hand. Unfold and press seal in right carefully without tension (critical area). If positioned incorrectly, the seal can still be pulled off, repositioned and pressed on again

- Mark the butt joint by pinning the loose end of the back on the already cemented end (small particles of dust stick on the adhesive tape) and cut off seal straight and press on the loose end at the same height

- Press on seal using a roller. Pressing-on force: approx. 30 N

- Peel off the rear and side tearing-off lips in area of the narrow flange

Important

Never touch the uncured adhesive surface after pulling off the seal

3 Checking Rubber Seal

- Cemented seals must be checked for correct position and perfect adhesion. The adhesion can be checked by pulling back the tearing lip. The force required to peel off the seal immediately after cementing must be greater than 10 N/cm

4 General Information on Rubber Seal Profiles

- Seals, which are supplied with partially loosened liners, must not be installed. Seals exist in 15 to 35 °C
- If the liner becomes loose during handling prior to cementing, the seal may not be installed
- Cement at ambient and storage temperatures of + 15 °C
- Temperatures between 40 and 50 °C will increase the initial adhesion considerably
- Seals, which are subjected to temperatures above 60 °C after cementing, will be very difficult to remove



54 13 054 ADJUSTING SUN ROOF

Height adjustment

Height:
Front = 1 mm deeper than roof panel
Rear = 1 mm higher than roof panel

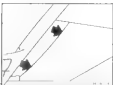
Length:
Equal distance (A) between top and rear at front and rear - check with a plastic gage

A is approx. 0.2 mm

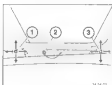


Adjust the sun roof to "0" position at left and right using a 4 mm hexagon key (1). L.M. was removed in picture for better understanding.
Key (1) connects the drive, cable (2) and gate (3).

If necessary, remove the motor/gear unit so be able to move the drive cables.



Open the sun roof about 15 cm



Loosen screws (1 - 3) at the left and right using Special Tool 60-2-130.

Adjust the lid.

If applicable, install the motor/gear unit in "0" position - refer to 54 13 050.
Remove the hexagon key.

Installation
Install new screws.
Tightening torque = 5.5 Nm.



Spread left and right clamps apart and slide the roof liner clamps back.
Close the sun roof.

54 12 005 ADJUSTING FRONT SUN ROOF LID (Towing)

Remove front roof liner frame - refer to
54 12 132

Ideal Adjustment

Equal distance (A) of lid to roof at front
and to rear (B)

Height

Front flush or up to 1.5 mm deeper
Rear flush or up to 1.5 mm higher

• Loosen screws

Installation
Tightening torque*

Installation
Tightening torque*

* Refer to Specifications

54 12 006 ADJUSTING REAR SUN ROOF LID (Towing)

Remove front and rear roof liner frames -
refer to 54 12 130 and 54 12 132

Ideal Adjustment

Equal distance (A) of lid to front lid and
roof at rear

Height

Front flush or up to 1.5 mm deeper
Rear flush or up to 1.5 mm higher

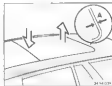
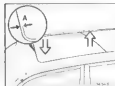
Loosen screws

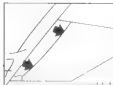
Installation
Tightening torque*

Unscrew all four nuts (2) and push the four
adjusting wedges (1) in or out far enough
until the ideal adjustment is reached.

Installation
Tightening torque*

* Refer to Specifications





54-12-100 REMOVING AND INSTALLING SUN ROOF LID

Open sun roof about 10 cm.



Spread left and right clamps apart and slide roof liner frame back.



Shut roof and loosen screws (1 and 3) using Special Tool 90-3-130.
Unscrew screw (2).
Remove lid.

Inspection
Adjust lid - refer to 54-12-004.
Replace screws.
Tightening torque = 3.5 Nm



Put left and right retainers towards inside and remove lid upwards.

54-12-102 Removing and installing front sliding/tilting sunroof cover (lowering)

Remove front headlining frame, refer to 54-12-101

Switch off ignition



54-12-102

54-12-103 Replacing front sliding/tilting sunroof cover (lowering)

Caution!

Note serial number (status), refer to Safety Service Information 54-02-02 (214)

Note repair instructions for bonded seals on sliding/tilting sunroof, refer to 54-5
Remove front sunroof cover, refer to 54-12-102

Release screws

Installation note
Refer to installation note in 54-12-103
Replace screws (and frame-encapsulated)
for tightening torque, refer to Technical Data 54-12-242

Release nuts and remove sliding/tilting sunroof cover by pulling upward

Installation note
Adjust front sliding/tilting sunroof cover, refer to 54-12-305
Replace nuts (micro-encapsulated)
for tightening torque, refer to Technical Data 54-12-242

Remove front rain channel

Note

The front sunroof cover features a (Y) stamped on the front side and has a weatherstrip (X) at the rear

Clean bonding surface

- (X) Affix weatherstrip (1) flush with respect to upper edge of sunroof cover (2).
- (Y) Weatherstrip (1) must protrude slightly at outside left and right sunroof cover (2).



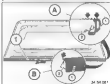
54-12-102



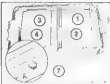
54-12-102



54-12-103



54-12-103



Installation note

1 a) Tilt slide sunroof cassette without embossing (1 - 4) on cross member and weld nuts (5) and (6) on both sunroof covers install 4 bonded washers (7) on cross member.

1 b) Tilt slide sunroof cassette without embossing (1 - 4) on cross member and weld stud (5) and (6) on both sunroof covers cannot be installed replace cassette



ME 1 100 11

54 12 104 Replacing rear sliding/tilting sunroof cover (lowering)

Caution!

Note serial number (nature), refer to BMW Service Information (54 02 07 (514).

Remove rear sliding/tilting sunroof cover refer to 54 12 105.

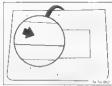


2 a) Tilt slide sunroof cassette with embossing (1 - 4) on cross member and side weld stud on rear sunroof cover (5) through cross member (4).

5 bonded washers (1 - 3), adhere 4 bonded washer (7) on cross member (4).

Fit M6 nut for weld stud (5) with a torque of 70*

2 b) Tilt slide sunroof cassette with embossing (1 - 4) on cross member and weld nuts (5) and (6) on both sunroof covers remove old washers (bonded) and fit 4 bonded washers (7) on cross member.



Note

Rear sunroof cover features a (P) stamped on the front side and has no weatherstrip.



* Source of supply: BMW Parts Service



54-12-101

Installation note:

1 a) Fit slide sunroof cassette without embossing (1 - 4) on cross member and weld nuts (3) and (6) on both sunroof covers.

1 b) Fit slide sunroof cassette without embossing (1 - 4) on cross member and weld stud (3) and (6) on both sunroof covers.



54-12-102



54-12-103

2 a) Fit slide sunroof cassette with embossing (1 - 4) on cross members and site weld stud on rear sunroof cover (1) through cross member (4).

Fit 100 mm bar for weld stud (3) with 1 secure 2 10*

2 b) Fit slide sunroof cassette with embossing (1 - 4) on cross members and site weld (3) and (6) on both sunroof covers.



54-12-104

* Source of supply: BMW Parts Service

54-12-106 Removing and installing rear sliding/tilting sunroof cover (fouring)

Remove front and rear headlining frame, refer to 54-12-132 and 54-12-133.

Switch off ignition

Installation note:

Grasp slide rails of cross members. (Rear GLI, Fuchs).



54-12-105

Release screws.

Installation note:

Replace rubber (photo encapsulated).

For tightening torque, refer to Technical Data 54-12-242.



54-12-106

Release nuts and remove sliding/tilting sunroof cover by lifting upward.

Installation note:

Observe installation note in 54-12-104. Adjust rear sliding/tilting sunroof cover, refer to 54-12-208.

Replace nuts (photo encapsulated).

For tightening torque, refer to Technical Data 54-12-242.



54 12 120

54 12 120 Replacing weatherstrip for sliding / tilting sunroof cover

Note:

If weatherstrip is peeling off, it can be repaired with cyano acrylic adhesive (Loctite 360)*, refer to 54 6. Repairing bonded weatherstrips on sliding/tilting sunroof.

Remove and install sliding/tilting sunroof cover refer to 54 12 100.



54 12 121

54 12 121 Replacing front weatherstrip for sliding / tilting sunroof cover (fourth)

Note:

If weatherstrip is peeling off, it can be repaired with cyano acrylic adhesive (Loctite 360)*, refer to 54 6. Repairing bonded weatherstrips on sliding/tilting sunroof.

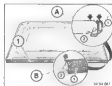
Remove front sliding/tilting sunroof cover, refer to 54 12 100.



54 12 120

Remove weatherstrip from sunroof cover.
Remove remnants of adhesive.

Installation note:
Install weatherstrips with adhesive.
Sealing lip facing forward.



54 12 121

Remove weatherstrip (1).
Clean bonding surface.

(A) Bond weatherstrip (1) flush with upper edge of sunroof cover (2).
(B) Weatherstrip (1) must project a little at outer left and right sunroof cover (2).



54 12 122 Replacing weatherstrip at sliding / tilting sunroof aperture (fouring)

Note:

If weatherstrip is peeling off, it can be repaired with cyano acrylic adhesive (Loctite 330)* refer to 54 12 123 Replacing bonded weatherstrips on sliding/tilting sunroof

Remove front and rear sliding/tilting sunroof cover refer to 54 12 102 and 54 12 104

Remove weatherstrip

Start disassembly and assembly at rear center

* Source of supply: BMW Parts Service

54 12 122 Removing and installing or replacing front headlining frame for sliding / tilting sunroof cover (fouring)

Open front sliding/tilting sunroof

Note:

The front finisher need only be removed for adjustment work, removal or replacement of the front sunroof cover

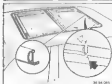
As of production date mid-March 92, the finishers are only clipped onto the A-pillar trim panel. These finishers cannot be mounted on "old" sunroof covers



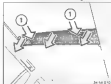
54 12 102 a



54 12 122



54 12 122



54 12 122



54 12 122

Date of production before mid-March 92:

If necessary, release front screws. Press both finisher (1) and empty at bottom

Installation note:

If finisher at front, push forward (7) and clip on at rear

If clips on finisher defective and no suitable finisher is available: Drill 3 holes through rear finisher and through headlining panel

Protect headlining panel from corrosion. Secure finisher with 2 self-tapping screws (see front)



Production date after mid-March '92

Unclip trimmer at bottom

54-12-133 Removing and installing or replacing headliner frame for sliding / tilting sunroof cover (touring)

Remove from headliner frame
refer to 54-12-132



Press down spring on left and right and slide headliner frame forward

Installation note

Engage left and right spring correctly



Close sliding/tilting sunroof

Press down spring on left and right and pull headliner frame forward a little



Push forward headliner frame

Press out front sliding tracks from release and (optional) slide headliner frame back a little until it can be tilted over the wind deflector

Pull headliner frame forward again and also press out center sliding blocks



Press up headliner frame on right and release by pulling down to left

Installation note

Engage spring on left and right correctly
Check function



Turn headliner frame and pull upward

Installation note

Check function

54-12-210 REMOVING AND INSTALLING COVER OF THE SUN ROOF FRAME (Covering)

Important!

Check manufacturing number (version status) - refer to Service Information of Group 54

Switch off ignition

Remove roof rail components - refer to Group 54



Loosen hose clamps at front and rear - left and right

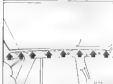
Note

Secure clamps to prevent them from falling into the s-pilans

Pull off water drain hoses

Important

Check function and for leaks



Pull complete wire harness off of sun roof contacts



Disconnect rear plug and unhook to rear CTs

Installation
Tightening torque*

* Refer to Specifications



Disconnect plug (also refer to "Replacing Module" - 54-12-215)
Unhook screw (2)

Installation

Tightening torque*

After disconnecting plug on module the sun roof must be initialized - refer to 54-00



Unhook screws

Installation

Tightening torque*



Unhook left and right screws

Installation

Tightening torque*



Unhook rear screws

Installation

Tightening torque*

* Refer to Specifications



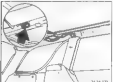
Installation
Jockey rearers at left and right sides and lift out sun roof cassette towards rear through the luggage opening with help from a second person



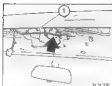
Installation
Paste approx. 10 cm ring strip of Heston tape* at front



Installation
Insert front end of sun roof cassette (1) into shell. Manual step (2)



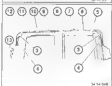
Installation
C-pillar end in rear section on left and right sides



Installation
Tighten front screw (1)
Tightening torque*



Installation
Tighten rear screw (2)
Tightening torque*



Installation
Keep up following screw tightening

(1) front left and right
(2) front left and right
(3) rear left and right
(4) rear left and right
(5) rear left and right
(6) rear left and right
(7) rear left and right
(8) rear left and right
(9) rear left and right
(10) rear left and right
(11) rear left and right
(12) rear left and right
(13) rear left and right

Tightening torque*

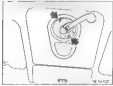
* Source of Supply: BMW Parts

* Refer to Specifications



54 12 120 REMOVING AND INSTALLING REPLACING GEAR UNIT FOR MANUAL SUN ROOF

Shut the roof.
Unscrew screw



Unscrew screws and remove a inner recess plate

Lift and remove roof panel

Unscrew winder

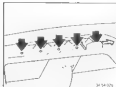


Unscrew screw and remove gear unit

Installation
Install winder and turn the gear unit to "0" position (pressure point).
Lubricate pinion lightly with grease*

54 12 141 REPLACING BOTH SUN ROOF DRIVE CABLES

Remove sun roof lid - refer to 54 12 130.
Remove motor/gear unit - refer to
54 12 010 or remove gear unit - refer to
54 12 230

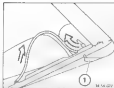


Push drive cables back uniformly on both sides.
Remove cover

Adjustment
Replace screws
Tightening torque = 1.8 Nm,
for both rear screws = 2.8 Nm



see illustration
Pull drive cables forward on both sides.
Arrest drive cable (2) and cable (3) in "90°"
position using key (1)
Install motor/gear unit



Pull drive cables out of guide pipes.
Press off linkage (1)

Illustration
Braided drive cables may get lubricated



Press drive cable (2) off of gear (1) in
center position
Drive cable (2) is marked
L = left
R = right

54 12 245 Removing and installing or replacing both front drive cables for actuation of sliding sunroof

Removes front sliding/rising sunroof, refer to 54 12 102

Removes front motor, refer to 54 12 091

Unfasten screws on left, right and remove intermediate (interaxle) CO

Note:
If necessary, work down weather

Press down spring (1) on left/right and slide sliding member backwards (2).

Remove retaining ring (1) on retaining pin (2) on left/right sides.
Drive out retaining pin (2) with punch.
Remove guide rail (3) from guide carriage (4) by lifting upwards.



With guide carriage at front, slide guide rail backwards until the assembly cover is exposed.



(A) Unfasten screws
(B) Remove assembly cover and threaded plate on left/right sides



Installation:
Replace screws (photo-encapsulated)

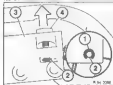
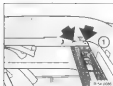
With guide carriage at front, pull guide rail forwards (neutral position)



Pull drive cables backwards: these are marked for left and right sides



Installation:
After fitting the assembly covers, slide left/right drive cables forwards to default position (basic setting).
Apply a drop of oil to the drive cables.
Fit motor and retaining pin.
Installation: refer to 54 0
Check function.



54 12 348 Removing and installing or replacing both rear drive cables for actuation of sliding/tilting sunroof

54 12 358 Replace both actuating unfolding units

Remove wind deflector refer to 54 12 495

Remove front drive cable

refer to 54 12 345

Remove rear sliding/tilting sunroof cover

refer to 54 12 108



Remove front cover frame from actuating unit holding unit on left/right sides

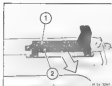
Remove rear motor, refer to 54 12 012



Unfasten screws and remove holding-down device on left/right sides

Installation:

Goal underside of holding-down device with



Remove sliding carriage (1) on left/right sides of front cover from sliding rails

Caution!

Do not lose titanium pads (2) (bevel faces towards rear)



Apply grease to underside of sliding carriage



Extend spring bracket on left/right sides and remove from sliding rails

Installation:

Apply grease to underside of spring bracket



Extend actuating unit/folding unit (1) on left/right sides as far as assembly aperture. Slightly release rear drive cable (2) and remove actuating unit / folding unit (1) on left/right sides from sliding rails

Installation:

Apply grease to underside of folding unit



This job 54 12 155 (replacing both actuating unit / folding units) ends here

Observe the following installation instructions

54-12 404 Removing and installing or replacing wind deflector (housing)

Open front sliding/tilting sunroof cover

Release left/right screw (2).
Remove left/right mount (3) and detach wind deflector (1).

For tightening torque refer to Technical Data 54-12 T42

Shift rear cover frame such that sliding tracks fall out of bracket.

Pull forward rear operating cable on left/right. Remove front (A) and rear (B) slides from sliding rails. Disconnect both operating cables.

Installation note

The rear slide (B) is longer.
All slides and operating cable holders are coded.

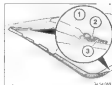
- 1 Coding for left control
- 2 Coding for front slide
- 3 Coding for rear slide

Lubricate operating cable with one drop of oil.
Grease bottom of slides.

Installation note

Push back operating cable with slides and left control until guide pin (1) engages in bracket of left control (basic setting).

Remove side motor.
Operating cables can now no longer be adjusted.
Initiative, refer to 54-9
Check function.



54-12 T42



54-12 T42



54-12-512 Replacing microswitch for sliding/tilting sunroof motor

Removing and installing motor/gearbox unit, refer to 54-13-010

Drill out hollow rivets and install new micro-switch into place.



54 13 004

54 13 005 Removing and installing or replacing coupling on front gearbox (fouring)

Ignition off
Lift out cover with folding leg.
Unclip hand crank to pin the cover.
Completely close hand-crank (neutral position).
If necessary, close hand-crank with help of emergency operator refer to 54 3 .



54 13 006

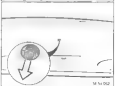
If necessary, unscrew screws (1) and (2) (aid construction status).
Lift coupling (2) out with hand crank pointing downwards.



54 13 007

54 13 008 Removing and installing or replacing rear coupling on gearbox unit (fouring)

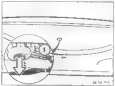
Ignition off
Lift out cover with folding leg.
Unclip hand crank from cover.
Sliding-ring universal must be in neutral position.
If necessary close using emergency operating mode refer to 54 3 .



54 13 009

Lift out plug by pulling downwards.

Note
If the plug diameter is < 20 mm, partially remove edge (mm).



54 13 010

If necessary, unscrew screws on the coupling (aid construction status).
Lift coupling (1) out with hand crank pointing downwards.



54 13 010 REMOVING AND INSTALLING SUN ROOF MOTOR AND GEARBOX

Switch off ignition.
Lift out cover using a screwdriver.

54 13 010



Shut roof.
If necessary, shut roof manually using the hexagon socket key.

54 13 011



Disconnect (1) and (2).
Disconnect plug and remove motor-gearbox unit.

Installation:
Screw (3) is longer.
Tighten to torque = 1.8 Nm.

54 13 012



Installation:
Install motor-gearbox unit only with closed roof and motor in zero position = bore (1) on one line with shafts (2).
If necessary, turn with help of hexagon socket key.

54 13 013



54 13 011 REMOVING AND INSTALLING REPLACING FRONT SUN ROOF LID MOTOR (Touting)

Switch off ignition.
Lift out cover using a screwdriver.

54 13 011

Shut roof completely (zero position).
If necessary, emergency (manual) closing - refer to 54 02.



Unscrew screws.
Disconnect plug and remove motor-gearbox unit.

Installation:
"tightening torque"
Initiate sun roof - refer to 54 02.

54 13 012

54 13 013 REMOVING AND INSTALLING REPLACING REAR SUN ROOF LID MOTOR (Touring)

Switch off ignition.
Remove rear roof liner section - refer to
Group 51

Shut roof completely (zero position).
If necessary, emergency (manual) closing
refer to 54 00

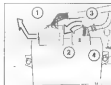


Unscrew screws (1 and 2).
Disconnect plug and remove motorgear
box unit

In connection
Screw (1) is longer
Lightening output - 2.0 Nm

54 13 015 REMOVING AND INSTALLING - REPLACING SUN ROOF MODULE (Touring - Rear)

Switch off ignition.
Remove rear roof liner section - refer
Group 51



Disconnect plug (1).
Press down retainer (3) and fit out plug (4)
together with screw (3) to the left

No tension
Carry out initialization



Unscrew screws and remove module

TROUBLESHOOTING SUN ROOF

Condition	Cause	Correction
Rattling noise	a) Front sliding shoes loose / defective b) Sun roof maladjusted c) Rubber strip missing	a) Tighten / replace front sliding shoes b) Adjust sun roof c) Install rubber strip (cover rails, glass drive cables)
Whistling noise	a) Excessive gap between roof and lid (front/rear)	a) Adjust lid / replace seal if necessary
Water entering car through roof hole	a) Sun roof maladjusted in D position b) Seals loose / damaged c) Wrong seal installed (Different seal profiles front/rear) d) Drain holes plugged	a) Adjust in D position b) Tighten / replace seals c) Install original parts d) Clean drain holes
Roof lid lifts excessively	a) Drive cables maladjusted	a) Adjust drive cables in D position
Sun roof lid moves too slow (motor runs slowly)	a) Maladjustment b) Motor/motor defective	a) Adjust sun roof in D position b) Replace motor/motor unit

61 Electrical system

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GENERAL INFORMATION

Important When Disconnecting Battery

Disconnecting the battery will erase fault memories of control units, so that fault memories should first be interrogated and any possible faults printed.

The radio can only be operated after disconnection of the battery by entering the radio code again, so that the customer should first be asked for his radio code card.

Note stored stations so that they can be stored again after connection of the battery.

The stored data of the on-board computer and clock will also be lost.

If car is fitted with an infrared locking system, all keys must be re-coded - refer to Car Electronic/Electronic Test Plan for additional information.

To disconnect the battery located under rear floor seat, remove cover on rear seat base at right bottom and unscrew ground cable at ground connection point.

Disconnect battery ground lead if battery is located in engine compartment.

Important With Connected Battery

Working on components with connections and so on could cause faults to be stored in fault memories of concerned control units.

If instructions in this Repair Manual specify disconnection of the battery, this must always be performed with in the interest of safety.

Outside Starting Aid

Do not start the engine with help of starting sprays

Preparations

Conform with the following when starting engine with starting cable

Ensure that starting cable wires are of appropriate cross section size

Only use fuse-protected starting cables.

Check whether the current supplying battery has 12 V voltage

If engine is started from battery of another car, ensure that there is no contact between the bodies of both cars

Caution

Never touch ignition system components under current - dangerous high tension!

Procedure

Always conform with the procedures to avoid injury to persons or damage to parts

Select range P in cars with an automatic transmission and apply the parking brake

Move the shift lever of cars with manual transmission into neutral and apply the parking brake

Ensure that the starting cables cannot get caught in rotating parts, e.g. fan

First connect both positive poles of the batteries with one starting cable (red)

Use the positive connection point in the engine compartment for cars with the battery in the trunk

Then connect the second starting cable (black) between the negative pole of the current supplying battery and engine or body ground of the car to be started

Caution

Never connect the second starting cable (black) on the negative pole of the battery in the car to be started! Produced gas could be ignited by sparks - danger of explosion!

If the battery in the car supplying power is weak, start the engine of this car and let it run at idling speed

After the engine of the car to be started has started up, first disconnect the starting cable on the negative pole - ground connection. Then change the starting cable from the positive poles

Outside Starting Aid and Car Telephone

Siemens C 2

When starting the car using the with outside help from another car, remember that over voltage could damage the Siemens C 2 telephone. Consequently always disconnect the sender and receiver from the electric system before using outside starting aids

Siemens C 3 and Motorola C 451

Senders and receivers of Siemens C 3 and Motorola C 451 telephones are protected against overvoltage, but car's may not be made or received during outside starting

Always pay attention to the operating instructions of different type and different make telephones. In case of doubt disconnect the sender and receiver from the car's electric system

Windshield Wipers (Wiping Motor)

In case of disturbance intermittent wiper and wiper speed step 1 are switched off by a protector

This protection remains effective even after eliminating the fault and can be cancelled by switching off the ignition - terminals 15 and R) for 3 minutes

Windshield Wipers (Rear Contact Force Motor)

In case of disturbance the wiper control (rear) regular wiper is switched off by a protector

This protection remains effective even after eliminating the fault and can be cancelled by

- disconnecting the battery for 30 seconds (important: all fault memories will be erased)
- or
- operating car (automatic cancellation)

Instructions for Removing and Reinstalling Electronic Control Units

Important!

Disconnecting the car's battery will cancel fault memories of control units. So that it is absolutely essential to interrogate fault memories prior to disconnection of the car's battery and to have the faults printed with the BMW Service Tester 3 prior to stored faults being then be cleared again.

Disconnection and connection of control unit plugs always requires that the ignition be switched off.

Removal and installation of components, relay's, fuses, etc. could cause the storage of faults in fault memories of control units capable of self-diagnosis. Consequently after finishing work on the electronic system it is always necessary to interrogate fault memories, investigate stored faults and cancel the fault memories.

Battery Care and Maintenance

The electrolyte level of present day maintenance batteries should be checked at least annually or at intervals of 25 000 km and corrected to the upper limit specified by the battery supplier with distilled water when necessary.

Excessive drying by the power consumption of control units even in standby mode is added to the natural self-discharging of a battery due to the increasing number of control units used in cars today. The batteries of cars in storage should be recharged at the great every six weeks to maintain the service life and avoid excessive discharging (refer to battery recharging calendar). The rate of self-discharging depends on the car model and equipment.

Charging Battery

If a standard or fast charger (e.g. Bosch SL 24 80¹) is used to charge a battery, the battery must be disconnected from the car's electronic system and removed in order to avoid damage to paint finishes and upholstery by the escaping gas.

Excessively discharged batteries could be damaged or destroyed by the very high initial current (high temperature).

The battery can remain connected when using an electronic charger (e.g. Siemens VS 80).

The electronics does not permit critical peak voltage.

An electronic charger also charges an excessively discharged battery with reduced current until a certain basic voltage is reached.

Refer to Service Information 61 00 00. There is doubt as to whether or not the battery charger in the workshop is suitable.

Important!

Always first measure the open circuit voltage before charging a battery installed in the car. If this voltage is 12 V or less, it cannot be excluded that one or more cells are faulty or that the battery as a whole is already pre-damaged.

In this case it is always necessary to remove the battery as escaping gas while charging could damage interior equipment.

Attempt to separate the faulty cells with low charging current.

Remove plugs from the separate cells in the interest of safety.

Also refer to 61 21 1.

Testing Battery

An objective statement on the charged condition of a battery is only possible by way of a load test with cold testing current.

This test can be carried out with a battery tester, for example

Bosch T 10 000¹ or preferably with

Bosch T 12 200²

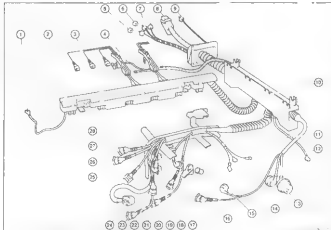
Additional information on load tests is contained in the pertinent operating instructions (refer to 61 20 1).

The acid density of a battery could be used to determine the charged condition.

This test, however, is not as positive due to the design-orientated dispersion range of acid density (e.g. charged standard battery contains a acid density 1.28 kg/ltr — 1 logic means a acid density 1.23 kg/ltr).

Another measuring factor is the acid layer immediately after filling with distilled water. Battery wear with partially sulphated and/or strongly contaminated plates will also lead to incorrect acid density test results.

¹ Source of Supply: BMW Parts



61-11/001 REPLACING WIRE HARNESS SECTION FOR 2000-2001

- 1 Ground lead-in of ignition coils (primary end)
- 2 Injection plate wiring channel
- 3 Wire to ignition coils
- 4 Battery positive wire
- 5 Relay for DME control unit
- 6 Relay for electric fuel pump
- 7 Relay for oxygen sensor heater
- 8 28-pin plug for DME control unit
- 9 Plug for air conditioner
- 10 Firewall wiring channel
- 11 Connections for starter
- 12 Battery positive wire for starter
- 13 Connection for diagnostic plug
- 14 Connection for engine plug
- 15 Connection for air mass sensor
- 16 Connection for tank venting valve
- 17 Connection for catalytic converter
- 18 Connection for intake air temp. sensor
- 19 Connection for cylinder leak sensor
- 20 Connector for TDC sensor of DME
- 21 Connector for throttle valve positioner
- 22 Connector for oil pressure switch
- 23 Connector for oil level switch
- 24 Connector for alternator
- 25 Connector for coolant temp. sensor of DME
- 26 Connection for temp. gauge sender
- 27 Connection at idling control
- 28 Wire harness carrier on engine block

The following plug connections could be installed:

VANDS control unit (tied back to vehicle by oil filter filter).
Refer to 11-30-010

Knock sensors 1 and 2

Caution
Mixing up both of these plugs will lead to engine damage!
Refer to 12-14-000

- Disconnect battery ground lead.
- Remove intake manifold.
- Remove cover from right fuse-relay plate.
- Remove cover from air conditioner pipes.
- Remove holder for wire harness from right wheel house.
- Remove cover for wire harness from firewall.
- Disconnect wire harness from right wheel house.
- Disconnect ground wire from body at right side.
- Disconnect battery positive lead.
- Remove holder for wire harness in right fuse-relay plate.
- Unscrew electric wire duct from firewall.
- Mark reaps and plugs in fuse-relay plate.
- Remove complete wire harness from fuse-relay plate.
- Remove cover from wire cover.
- Pull all plugs off of ignition coils.
- Unclip wires in cover.
- Mark plugs and disconnect plugs from engine.
- Disconnect engine plug and diagnostic plug.
- Cut off wire straps from carrier on the engine block, at the right and remove wire harness.



Important!
The engine wire harness for Bosch DME and Siemens MS 40 are different.

See part numbers.

Changed coding of plugs for sensors (e.g. temperature sensor, lifting speed control, engine control unit).

Additional connections for knock sensors (1 and 2) below the lifting speed control (Siemens MS 40).

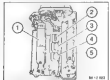


ENGINE WIRE HARNESS PLUG CONNECTIONS

Mutual ground lead of ignition coils (primary circuit)



Plugs of ignition coils



Electronic fuse plug connections

- 1 Electronic control unit plug (ECU)
- 2 DME master relay
- 3 Fuel pump relay
- 4 Oxygen sensor heating relay
- 5 ABS control unit plug



- 1 Air conditioner additional wire harness plug
- 2 Cruise control additional wire harness plug



Connections of starter motor



1 Diagnosis plug



3 Engine plug



1 Air mass sensor



2 Tank vent valve



Plug of catalytic converter



Plug of intake air temperature sensor



- 1 Oil pressure sender
- 2 Cylinder identifying sender for DME
- 3 TDC sender for DME



Plug for throttle valve potentiometer



Connections of alternator



- 1 Coolant temperature sensor for DME
- 2 Temperature sender for temperature
- 3 Cylinder identification for DME
- 4 TDC sender for DME
- 5 Idle speed control



61-13/131 REMOVING AND INSTALLING

Disconnect battery ground lead.
Mark and lift out all relays.
See Test Plan for relay connection plan.



Mark installed position of cover holder.
Unscrew screws and lift out cover holder.



Unscrew screws (with Torx socket) and lift upper box sections.



Push back clips on left and right sides of fuse plate and lift out plate downwards.



LM1 looking out of holder



Push back tab of partition plug with Special Tool 61-1-141 and pull out plug downwards.

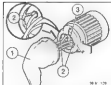


61-13 REMOVING AND INSTALLING WIRE CONNECTORS IN PLUG RECEPTACLES

Use set of Special Tools 61-1-132 for this purpose.

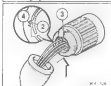
Application Information

Only plugs with additional receptacle tools are described in these instructions. The pins of plugs not described in this section can be pressed out with a suitable pressing out tool. After repairing plugs it is always very important to make sure that the locks of plugs have engaged.



7 and 8 Pin Round Male Plugs

Push rubber grommet (1) off carefully.
Push back retainers (2) of interior plug (3) carefully.



Slide interior plug (3) in direction of arrow until retainers (2) lock in locking groove (4).

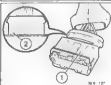


Push back steel spring locks (5) of permanent pin using Special Tool 61-1-132 and pull out wires.



Ultrasonic Bonded Plugs

Pins of plug (1) are bonded ultrasonically and cannot be replaced.
They can be recognized by the bonds (2) on the long side of the plug.



Pins of plug (1) are bonded ultrasonically and cannot be replaced.
They can be recognized by the bonds (2) on the long side of the plug.



13 Pin Round Male Plug

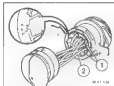
Pull rubber sleeve (1) off
Pull lock (3) out carefully in direction of
arrow



Move plug lower section (3) in direction of
arrow far enough that retaining (4) lock in
locking groove (5)

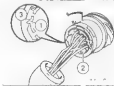


Push back retaining locks (6) of permi-
nent pin using Special Tool 61-132 and
pull out wire



25 Pin Round Male Plug

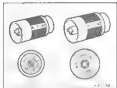
Push back retaining (1) of interior plug (2)
carefully



Turn interior plug (3) far enough that its
latch (1) lock in locking groove (2)



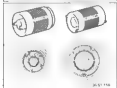
Push back retaining locks (4) of permi-
nent pin using Special Tool 61-132 and
pull out wire



Round Male Plugs with Single Core Seal

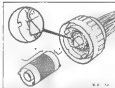
Special Tool 61-1143 = unlocking tool for 4-pin plug

Special Tool 61-1142 = unlocking tool for 7-pin plug



Special Tool 61-1142 = unlocking tool for 7-pin plug

Special Tool 61-1143 = unlocking tool for 25-pin plug



Unlock plug:
Insert suitable connection end of special tool into plug and turn counterclockwise approx. 3 degrees



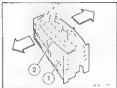
Plug locked:
Position of receiver (2) in locking groove (1)

Plug unlocked:
Receiver (2) in groove (1)



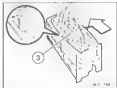
Push back steel spring locks (4) of pertinent pins using Special Tool 61-1122 and put out wire

61-13-5

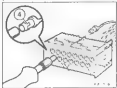


16 Pin Plug

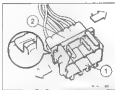
Pull exterior plug (1) out slightly in area of retainers (2) carefully



Pull interior plug (3) in direction of arrow as far as it will go

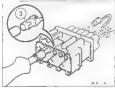


Push back steel spring locks (4) of permanent pin using Special Tool 61-1-132 and pull out wire

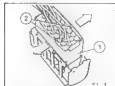


8 and 12 Pin Plugs

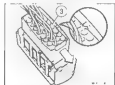
Move plug upper section (1) and plug lower section (2) against each other in direction of arrow



Push back steel spring locks (3) of permanent pin using Special Tool 61-1-132 and pull out wire

**30 Pin Plug**

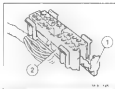
Pull exterior plug (1) out slightly in area of retainers (2) carefully.



Pull interior plug (3) in direction of arrow as far as it will stop.



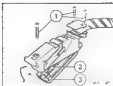
Push back steel spring locks (4) of pent-nut pin using Special Tool 61-1-135 and pull out wire.

**30 Pin Relay Module Plug**

Pull locking slide (1) out of plug (2).



Push back steel spring locks (4) of pent-nut pin using Special Tool 61-1-135 and pull out wire.



28, 38 and 55 Pin Control Unit Plug

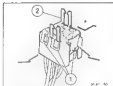
Unscrew Phillips screws (1)
Pry out pin socket (2) with seal (3) in direction of arrow



Pull off seal (3)
Pull out receptacle lock (4) in direction of arrow and unlock it

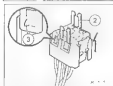


Push back steel spring lock (5) of pin socket pin using Special Tool 61 1 134 and pull out wire



Relay Carrier

Carefully pull relay holder (1) of relay holder (2) in direction of arrow.



Push relay holder (2) in direction of arrow into heel catch (3)

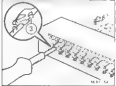


Push back steel spring lock (4) of pin socket pin and pull out wire
Press out wire 5.0 double flat spring pins with Special Tool 61 1 126
Press out wire 3.0 double flat spring pins with Special Tool 61 1 127



Fuse Plate

Pull condensed fuse coil of fuse plate (1).
(Mark position when removing all fuses.)
Pull locking screw (2) out of fuse plate (1)
as far as stop.



Push back steel spring locks (2) of parti-
tion pin using Special Tool 61-1-128 and
pull out wire.



Main Relay Plug of DME

Unlock locking flap (1) of concerned wire.



Push back steel spring locks (2) of parti-
tion pin using Special Tool 61-1-128 and
pull out wire.

61-13-9



Display Lamp

Apply Special Tool 61-1-128 on perimeter display lamp, turn counterclockwise (in direction of arrow) 90° and take out display lamp.



25-Pin E&S Plug (Electronic Plug) since 8/91.

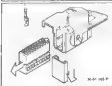
Unlock lock



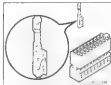
Loosen wire strap



Pull off cover



Pull out pin carrier



Insert pin



Important!
Don't forget to tighten the wire strap.



61 13 **REPAIRING WIRE HARNESS**
with 61 13 001 or 61 13 002 001-
002 PARTS ASSORTMENT IV
(Special Tool 61 13 002)

Safety information

Always find the cause of damage (e.g. sharp edge/body parts, faulty equipment, seized mechanisms, corrosion from penetrated water, etc.) before repairing a wire harness.
Interrogate fault memory
Eliminate cause of damage
Disconnect battery ground cable

Important

Only repair a wire harness if according to the wiring diagram no safety-related systems (e.g. ABS, airbag, rest and restraint system, etc.) are influenced.
Otherwise replace the faulty wire harness or use repair wires (refer to Service Information 61 13 34 and Page).

Check function and interrogate fault memory again after repairing a wire harness. Eliminate new faults if applicable and erase the fault memory.

Instructions are supplied with Special Tool 61 13 002.
Information for ordering parts and a list of parts are a part of these instructions.



SPECIAL TOOLS FOR WIRE HARNESS REPAIR

Hand piece without marks 61 13 041
(part of Special Tool 61 13 002)



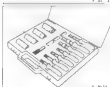
Marks 61 13 042 for hand piece 61 13 041
(part of Special Tool 61 13 002)
Applications

- 1 Crimping steps on electric wires in cross section size from 0.5 to 2.5 mm²
- 2 Pushing contact sleeves onto comb-type connectors

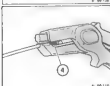
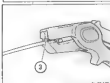
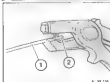


Stripping pliers with wire cutter 61 13 043
(part of Special Tool 61 13 002)
Applications

- 1 Stripping (PVC) insulation from wires in cross section size from 0.5 to 4.0 mm²
- 2 Cutting copper and aluminium wires in cross section size up to 3 mm²



Special Tool 61 13 100
Set of unlocking tools for 2.5 mm plug system - pressing-out tools for pins



STRIPPING WIRES

Use Special Tool 61-13/12

Guide in wire (1) until behind the knife.
Length of wire behind the knife is equal to the stripped length.

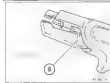
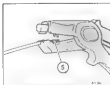
Stripped Length

Wire Size
in mm
0.38 to 0.60
0.75 to 1.00
1.00 to 2.00

Stripped Length
in mm
4.0
4.5
9.0

Squeeze pliers until the wire is held tight
by jaws (3).

Squeeze pliers further as far as stop.
This strips wire (4).



Open pliers and remove stripped wire (5).

CUTTING WIRES

Use Special Tool 61-13/12

Push upper grip of stripping pliers (6) in
direction of arrow until the cutters are
visible.
Open pliers in final position and hold in
this position.

Hold wire (8) between the cutters and
squeeze pliers as far as stop.

Refer to the instructions supplied with Special
Tool 61-13/12 for further information.



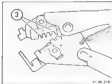
CRIMPING ON STOPS

Use Special Tools 61 9 041 and 61 9 042

Strip wire.



Unlock special tool.
Squeeze grips (1) tightly and push unlock lug lever (2) in direction of arrow.
Squeeze pliers as far as stop which causes the pliers automatically.



Designations on wires (3) of Special Tool 61 9 042 indicate which contacts can be used to which crimping stops.
The following wire cross section sizes and their corresponding stops can be used:

0.25 to 0.5	mm ²
0.75 to 1.0	mm ²
1.5	mm ²
2.5	mm ²



Example
Comb sleeve 1.0 - 2.0 mm² for comb type connector

Refer to the instructions supplied with Special Tool 61 9 042 for further information.



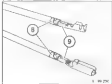
Place contact (stop) in previously determined nest



Preload contact by squeezing the matrix in the hand pliers.
Important!
Only squeeze the hand pliers enough to prevent the contact from falling out of the matrix in the hand pliers.



Insert stripped wire end (7) into contact. Ensure that insulation and stripped wire end seat correctly in the contact. Squeeze hand pliers as far as stop - the hand pliers unlocks automatically.



Take contact out of hand pliers.
Check insulation crimp (8) and wire crimp (9) for correct crimping as shown in the following figures.



61-13/14

Correct Crimping
 Valve wire and (10)
 valve insulation and (11).



61-13/14

Incorrect Crimping
 Wire and (10) valve insulation and (11) wire crimp.
 If necessary, repeat crimping with a new contact.



61-13/14

Wire and (10) valve insulation and (11) wire crimp.
 If necessary, repeat crimping with a new contact.

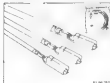
Refer to the instructions supplied with Special Tool 61-1-020 for further information.



REPAIRING PLUG ON WIRE HARNESS

Two different sets of tools are provided in Special Tool 61-1-020 for wire harness repairs.

Refer to the instructions supplied with Special Tool 61-1-020 for further information.



61-13/14

Example
 Repair for air control sleeves on carburetor connectors.



61-13/14

Select repair set and remove following parts:
 Prepared wire and in required wire cross section size (1), butt connector for selected wire cross section size (2), shunt-on sleeve (3).



61-13/14

Unlock receptacle, using Special Tool 61-1-180 for this purpose.
 Also refer to instructions supplied with Special Tool 61-1-180.
 Mark damaged contact (4) with section number of receptacle and press it out of the receptacle using the pertinent special tool contained in Special Tool 61-1-180.



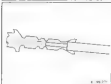
Cut off wire with side cutters (5) at point which is easily accessible.
Important:
Check maximum length of repair wire! If more than one wire has to be repaired, the ends of wire ends must be arranged offset so that the wire harness will not be too thick at the repaired point.



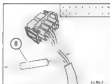
Strip wire harness wire end (6)



Cut off repair wire (7) to required length and strip end of wire



Crimp butt connector on wire harness end



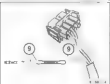
Install shrink-on sleeve (8) on unused wire end



Crimp unused wire end with butt connector



Push shrink-on sleeve over butt connector



Shrink the shrink-on sleeve with heat from a hot air blower until contact flares out on both ends (9) and (10) of the shrink-on sleeve uniformly.
Important:
Don't burn the shrink-on sleeve.

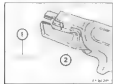
Install contact in appropriate



INSTALLED COMB TYPE CON-
NECTOR FOR SERVICE IN-
STALLED EQUIPMENT

Comb-type connector required insulating
sleeve and tools are contained in Special
Tool 61-9-030

Refer to the instructions supplied with Special
Tool 61-9-030 for further information



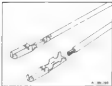
Put through wire loop in wire harness using
Special Tool 61-9-043



Strip both wire ends



Strip contacts up to wire gauge section
also.



Crimp on contacts using Special Tools
61-9-041 and 61-9-042



Take comb-type connector out of Special
Tool 61-9-030 and shorten it to the required
number of pins



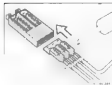
Use Special Tools 61-9-041 and 61-9-042



Place 4-pin comb-type connector in Special
Tool 61-9-041 and 61-9-042



Place wire with contact on comb type



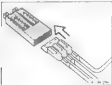
The insulation receptacle must be sealed if it is installed outside of the car's interior compartment.
Seal the receptacle with silicone and mount it on the body.



Squeeze special tool and push on contact at the stop



Installed comb type connector



Slide assembled comb type connector into insulation receptacle until it locks.
Mount insulation receptacle on body.



TOOLS FOR WIRE HARNESS REPAIRS OF REPAIR ASSORT- MENTS . II AND III

These repair assortments are available from BMW Parts

Repair assortment for electric system I
Order No. 81 24 9 408 280

Repair assortment for electric system II
Order No. 81 24 9 408 300

Repair assortment for electric system III
Order No. 81 24 9 408 400

They are primarily required for repairs on models of E 12, E 21, E 23, E 24, E 28 and E 30 Series



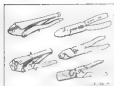
81 24 9 408 128

Hand pliers Super Change IT from Electric System Box I
Order No. 81 24 9 408 128



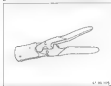
81 24 9 408 127

Hand pliers for ignition lead contacts from Electric System Box I
Order No. 81 24 9 408 127



81 24 9 408 400

Survey of applied hand pliers in boxes for Electric Systems I, II and III



81 24 9 408 399

Hand pliers for "Modu" (assembly) contacts from Electric System Box II
Order No. 81 24 9 408 399



81 24 9 408 129

Hand pliers Compact I from Electric System Box I
Order No. 81 24 9 408 129



81 24 9 408 400

Hand pliers for 2,5-mm contacts from Electric System Box II
Order No. 81 24 9 408 400



Other information and tool application information:

Operating instructions: Order No. 61 8 004

Wire repairing tool of repair equipment for Electric Systems I, II and III

Contents of instructions among others:

- 1 Application of tools
- 2 Reduced susceptibility to repairs
- 3 Better repair process

Send orders for operating instructions to:

Carlson GmbH
Alfred Wegner Str. 5
4010 Mönchengladbach
Germany

**BATTERY HIGH CURRENT TEST
for Starter Batteries**

Test with Bosch Tester 12 2000 *



Connect the battery tester and set the coils testing current rated capacity according to the battery specifications.

There is high current load of approx. 300 A with electronic evaluation of the voltage pulse during and after load.
This test is presently the most dependable method of evaluating the charged condition and physical battery condition (such as cell shorts, sulphation).

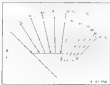


Switch all consumers off.
Switch the ignition off and wait 3 minutes.
Start the test as described in the operating instructions.



Test Procedures

Connect the battery tester
Ground points of engine wire harness at electronic test in front of the engine compartment (street)
Remove cover



Only scales B and C are required for the evaluation of batteries.



* Source of Supply: BMW Parts

LIMITS FOR EVALUATION OF ALL BATTERIES (Except Telephone Batteries)

Charged Condition ¹	Starting Power ¹	Test Results		Faulty
		OK	Charge	
Test Step 1 - Before Charging Battery				
Not testable			X	
Less than 50 % ¹			X	
More than 50 %	Less than 75 %		X	
More than 50 %	More than 75 % ^{2a)}		X	
More than 50 %	More than 75 %	X		
Test Step 2 - After Charging Battery				
Not testable				X
Less than 50 % ¹	Less than 75 %			X
More than 50 %	More than 75 % ^{2a)}		X	
		X		

1) Charged condition and starting power must always be evaluated combined

2) Test Charge: Longer than 5 hours with charger Cossack CS 2 or Start-to-Go™ WB 50!

3) Full Charge: With charged condition is more than 80 %

1) Charged condition and starting power must always be evaluated combined

2) Test Charge: Longer than 5 hours with charger Cossen CS 2 or Siemens-Cossen WB 501

2a) Full Charge: With charged condition is more than 90 %

Note
If the battery was tested from the positive connection point in the engine compartment, repeat the test direct on the battery to be sure of correct test results.

41 20 CHECKING BATTERY IN OPEN CIRCUIT CURRENT TEST

If the battery is okay after the high current test, battery discharging could be caused by excessive open circuit current consumption.

Before Open Circuit Current Test

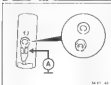
Vehicle must have been unused at least 3 hours.
Switch all consumers off which can be switched off (ignition, brake lights, reading lamps, seat heating, additional heater, additional ventilator, telephone, etc.).
Shut the governor, crumple/pull lid and engine hood.

Keep to the following procedures so that possibly testing relays do not fail.

Connecting Ammeter

Connect the positive lead of the ammeter to the disconnected ground connection.
Connect the (ground) lead of the ammeter to the other lock striker.

If the striker is lined with plastic, the eager lighter ground wire in the rear of the car must be used.
Remove the panel.



Remove the shrink-fit hose on the body end of the battery ground lead (see pictures) for a battery installed underneath the rear seat. Clip on a cable with an alligator clip at this point (Hirschmann AK 2 5 clip together with test leads, red = Order No. 81 1 472 and black = Order No. 81 1 474).

Clip a second cable on the surface of the right rear door or at ground on the rear cigar lighter.

Close, lock and arrest (double-lock) the driver's door, front passenger's door and left rear door.

The right rear door remains open.

Disconnect the battery ground lead with connected alligator clip on the ground connection point carefully 5 minutes after the locking step and bend it away.

Static current now flows only via the multimeter.

Simulation of the closed car by pressing the door contact switch on the driver's head static current value on the multimeter.

If the static current is more than

50 mA,

it can be assumed that a hidden consumer is loading the battery.

The hidden consumer can be pinpointed by pulling off fuses, possibly relays and control units one after the other.

When testing and possibly troubleshooting have been concluded, the multimeter must be removed in reverse order of installation so that the memories of the radio, on-board computer and various control units are not corrupted.

Static Current Test in Cars with Burglar Alarm

In order to be able to measure the actual static current, the door contact of the open right rear door must be pressed 5 minutes after the locking step.

The door contact must not be released immediately after reading the static current, because then the burglar alarm horn would be active. This excessive current for the selected measuring range of the multimeter could destroy the instrument, but at least the installed fuse.

The ground lead must always be reconnected in reverse order of disconnection in order to be able to deactivate and unlock the car correctly.

8-29 REMOVING AND INSTALLING ADDITIONAL BATTERY

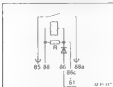
Disconnect ground leads of both batteries.

PURCHASE: \$299.95; **RENTAL:** \$79.95 PER WEEK

Black trunk wire parked on right wheel
house inside.



- 1 Additional battery
- 2 Battery cut-off relay
- 3 Parked car heating control unit



Walking colleagues: healthy cost-cutting move

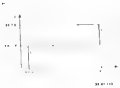
61 21 1 CHARGING BATTERY

Only chargers with the following properties are suitable for charging the battery in the car with connected car power supply

- Current limitation for strongly discharged batteries (regeneration of slightly predamaged batteries)
- Switchover or shutoff after reaching 14.4 V passing voltage
- Direct current voltage with harmonic wave less than 1 V

Sample Chargers:
Siemens/Gossen VB 801

See voltage/induction charging curve



Voltage/Induction Charging Curve Shows:

1. Charging with minimum current up to passing limit voltage of 14.2 V, whereby charging in range of about 13.2 to 14.2 V could last relatively long, because in this limit range charging is with very low current.
2. Charging of strongly discharged batteries with an initial current of approx. 3 A up to a terminal voltage of approx. 7 V, at which maximum charging current occurs.

Battery chargers without these properties lead to damage in the car. The battery must be disconnected from the car power supply system when using any other chargers. Take battery out of the car when charging with non-regulated chargers (see Operating Instructions).



61-31 . . . REPLACING ONE STEERING COLUMN SWITCH

Disconnect battery ground lead
 Remove steering wheel — see 33-33-000
 Remove trim panel for dashboard at bottom left — see 51-43-180
 Unscrew screws and take off lower steering column casing section.

Car with Airbag:
 Unscrew screws and take off lower steering column casing section.

Drive out pins and lift out expansion feet.
 Take off upper steering column casing section.



61-31 015 REPLACING TURN SIGNAL SWITCH

Remove casing sections — see "Replacing One Steering Column Switch"
 Pull off plug.

Squeeze locking hooks on both sides and pull out switch.
 Disconnect all plug connections.

Installation
 Mount turn signal switch in turn signal indicating position and then install the steering wheel.

61-31 016 REPLACING CRUISE CONTROL SELECTING SWITCH

Remove casing sections — see "Replacing One Steering Column Switch"
 Press down on lever and pull out switch.
 Disconnect plug.



61-31-030 REPLACING IGNITION SWITCH

Remove casing - refer to "Replacing One Steering Column Switch"
Compress retainers on both sides and pull out switch.
Disconnect plug

Important:
After installation carry out mechanical (lock cylinder) and electric (e.g. ignition, radio, etc.) tests.

Installation

Check position of ignition switch to steering wheel top and turn signal switch to steering wheel.



61-31-040 REPLACING WIPER SWITCH

Remove casing - refer to "Replacing One Steering Column Switch"
Compress retainers on both sides and pull out switch.
Disconnect plug

Installation

Check position of turn signal switch to steering wheel.

34 61 028



61 31 028 REPLACING LIGHT SWITCH

Push switch frame to the right and press in locking hook with a 1.6 mm thick feeler gauge blade.

Remove switch frame

Pull off plug
Press switch forward out of the switch frame

Installation
Press in locking hook with a feeler gauge blade and engage switch frame in

61 31 070 REPLACING SWITCH FOR FRONT FOG LAMPS

See "Replacing Light Switch" in 61 31 028.

61 31 ... REPLACING SWITCH FOR DRIVING INSTRUMENT LIGHT

See "Replacing Light Switch" in 61 31 028.

61 31 ... REPLACING SWITCH FOR HEADLIGHT VERTICAL AIM CONTROL

See "Replacing Light Switch" in 61 31 028.



61 31 051 REPLACING SWITCH FOR HEATER BLOWER

See "Replacing Heater Controls" in 64 11 200

61 31 086 REPLACING PROGRAM SWITCH FOR TRANSMISSION CONTROL (EH)

Testing - see BMW Test Plan in Gr 34

Checking
Program switch is moved to position with the ignition "ON"



34 61 027

61 31 115 REPLACING SWITCH FOR POWER WINDOWS

Wrap adhesive tape around a round-edged piece.
Apply round-edged piece on left and right sides of the middle bar and pull up on left and right sides separately to pull out the switch.

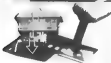
NOTE
Operate switch so that it will be easier to apply the round-edged piece.

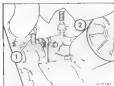


Pry out wood ornament on center console.



Press out switch.
Pull off plug.





61 31 280 REPLACING OIL PRESSURE SWITCH

Oil pressure switch (1) is on base of the oil filter.
Unscrew oil filter cover to have the oil in the oil filter flow back into the oil pan.
Pull off plug.

Unscrew switch.

Installation
Tighten oil filter cover
install switch.



M 21
Pull off plug.
Remove oil pressure switch.



M 22
Unscrew oil filter cover to have the oil in the oil filter flow back into the oil pan.
Unscrew switch.

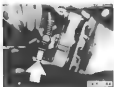
Installation
Tighten oil filter cover
install switch.



Unscrew coolant separator tank.
Remove oil pressure switch.

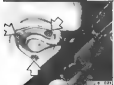


M 20
Remove engine splash guard - see Group 11.
Pull off plug.
Remove oil pressure switch.



61 31 389 REPLACING ENGINE OIL LEVEL SWITCH

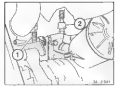
M 30 and S 38
Drain engine oil
Disconnect plug on engine carrier



Unscrew screws.
Remove switch



Disconnect plug between engine block
and alternator
Pull out switch



61 31 REPLACING OIL TEMPERATURE SENDER

S 38:
Oil temperature sender (2) is on base
of the oil filter
Unscrew oil filter cover to have oil in-
the oil filter flow back into the oil pan.
Pull off plug.
Remove sender with Special Tool
00 9 140



Installation:
Tighten oil filter cover
Install sender



12 4 3 21

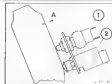
61 31 300 Replacing brake light test switch

Remove dashboard trim panel at bottom left
- 51 45 180.
Remove cable plug.
Remove cover.



33 00 010

Loosen nut (1), upper nut (2) and move test switch backwards.



31 41 10

Installation:
Brake pedal in rest position.
Adjust brake light test switch.
Dimension A ± 5.5 - 8.0 mm
1 = Brake light test switch
2 = Brake light test switch
3 = Brake pedal (in rest position)



21 01 300

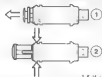
Note:
In cars whose switch has a 4-pin plug housing, the brake light switch and the brake light test switch share the same housing.
Adjustment as per 61 31 300.



32 01 300

61 31 310 Replacing brake light switch

Remove dashboard trim panel at bottom left
- 51 45 180.
Remove cable plug.



31 41 10

Depress brake pedal

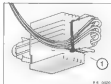
- 1 Pull upper and sleeve straight forwards
- 2 Press together retaining clips and pull

Installation

Install switch as shown in 2.
Adjustment is performed automatically.
Release pedal slowly to rest in position.

Caution!

Adjustment of the switch can be changed if brake pedal springs back.
Check function.



31 01 300

Caution!

On vehicles with electronic brake light switch (identified on radiator fins), always tie back lines to switch with cable clip (1).



#1 21 350 REMOVING AND INSTALLING REPLACING THE GATE GRIP MICROSWITCH

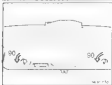
Remove the tailgate trim panel.
Unclip caps of screws.



Unclip cap of screws.



Unscrew screws.



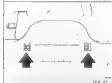
Open the hoodlids.



Remove clips.



Unscrew left and right screws.



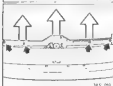
Unscrew screws.



Shut the tailgate.
Unscrew cap of the wiper crank



Under the screw


Take the micro panel out of the clips carefully.
Shut the gate.


Tiegate Survey

Disconnect plug (1).


Loosen the wire grip.
Disconnect the plug.


Push the resistor back



Remove the switch

Installation
 Check the installed position of the micro-switch.
 Check function.



61-31-350 REMOVING AND REINSTALLING REPLACING TAIL GATE LOCK (LOCK CYLINDER) MICRO-SWITCH

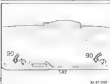
Remove the tailgate trim panel
Unclip cap of screws.



Unclip cap of screws.



Unscure screws.



Open the toolbox



Remove clips.



Unscure left and right screws



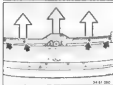
Unscure screws.
Unscure screws of the grip recess plate



Shut the tailgate
Unscure cap of the wiper arm



Unscrew the cover



Take front panel out of the clips carefully



Disengage the linkage



Loosen the wire grip.
Disconnect the plug.



Loosen screws.
Tightening torque*



Push the retainer back



Remove cap.



Installation
Check the installed position of the micro-
switch.
Check function

* Refer to Specifications

61 31 355 REMOVED AND REINSTALLING REPLACING TAILGATE WIL- DOWN LOCK MECHANISM

Removes the tailgate trim panel.
Unclip caps of screws.

Unclip cap of screws.

Unscrew screws.

Open the toolbars

Remove clips.

Unscrew left and right screws

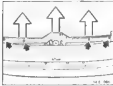
Unscrew screws
Unscrew screws of the grip recess plate

Shut the tailgate
Unscrew cap of the wiper panel





Unscrew screw



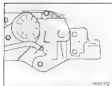
Take trim panel out of the clip cavity



Unscrew screws



Unscrew screws of the support



Support removed



Press the retaining hook back
Loosen the wire strap
Remove microswitch (1)

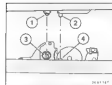


Disconnect the plug



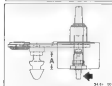
Disconnect the plug

Installation
Check the initial position of the microswitch
Check function

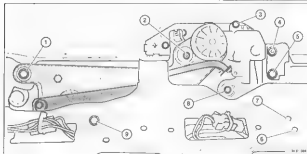


Installation

Lockpin (1) of the target window lock and crankpin (2) of the trigger must engage in lock (3) and (4) of the target.



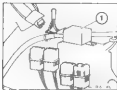
The depth of the target window lock must be adjusted to a depth distance A of 29.5 mm so that the crankpin of the trigger arm will engage deep enough in the opening of the output disk.



Lockpin adjusted (1 - 8)

Shut the target window.
The lockpin should be adjusted to correct depth.

Tighten screws (1 - 8).
Tightening torque:
Check the wiped zone.
Check function.



**61-31-437 Removing and installing or
replacing wiper/wash control
unit for rear window**

Remove wheel arch trim from right side of
trunk, refer to 51-47 081

Remove control unit (1).

**61-31-440 REMOVING AND INSTALLING
REPLACING TEMPERATURE
SWITCH FOR HEATED WIND-
SHIELD SPRAY NOZZLES**

Description of Operation
The temperature switch is series connected
with the heated spray nozzles.
ON temperature 2 to 10° C
OFF temperature 8 to 10° C



Disconnect plug
Additional information
wiring diagrams for E 34 models

When Troubleshooting
Switch is open most of the time as the air
blast temperature is usually higher than
10° C
Application of cold spray will very seldom
cause switching on as a reaction time of
several minutes is acceptable

Remove front bumper refer to Group 51

Location
Below impact absorber on right-hand side
of car



Unclip switch in holder

41 21 470 REPLACING RELAYS MODULE (OPTION REAR SEAT)

Interrogate the test memories
Disconnect the battery
Remove the rear seat cushion refer to
Group 82

Uncover socket.
Remove the cover

Apply Speed at Rest (00 5 590)
Pull the module out.

Removed in this picture

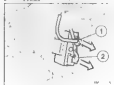
Caution!

If the battery is not disconnected, wrong equipment versions will be stored taking the basic module as an example. In this case some special equipment would not be recognized. For example, the power window regulators would not work.



61 35 900 Removing and installing or replacing ring antenna of electronic vehicle immobilizer

Remove steering column shroud at bottom
Unclip ring antenna



Disconnect plug connector (1) and remove ring antenna



61 35 905 Removing and installing or replacing transceiver module of electronic vehicle immobilizer

Remove steering column shroud at bottom
Disconnect plug connectors (1) and (2)



Press clip towards module and remove module by pulling downwards



61 35 910 Removing and installing or replacing control unit for electronic vehicle immobilizer

Remove plug
Release screws



Detach trim panel
Remove knee guard if necessary (US)



Remove screws
Detach trim panel



Disconnect plug connector - release screws
and remove control unit



61 61 070 REMOVING AND INSTALLING COMPLETE WIPER CONSOLE

Run wipers to park at position.
Remove heater blower - refer to 64 11
Tilt wiper cover

Important:

Set air volume control wheel to zero and switch ignition on and off before disconnecting cable in order to have the drive motor close the ventilation flaps.



Disconnect battery ground lead.
Disconnect cable completely
with out damage continuity



Pull off temperature sensor



Remove retainers, lift cover slightly and remove inlet covers on left and right sides.
Then remove cover



Installation:

Check installed direction of inlet covers.

1. Insert screw
2. Press air flap
3. Blower wheel (not yet installed)
4. Inlet cover

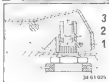


Unscrew screws



Unscrew wiper arm

Left Wiper Arm
Fold up cover, unscrew screw and take off wiper arm, wiping the gap with a screw driver if necessary



Installation:

Place on wiper arm fully as otherwise wiper contact force regulation will not work properly.
Tighten screw (1) to specified torque.
Screw in stud (2) as far as pin (3) until there is no longer play.
In gaps adjust wiper contact force regulation tighten wiper arm nut to specified torque.
Wait 10 minutes and tighten again specified torque

* Refer to Specifications



Right Wiper Arm
Fold up cover, unscrew nut and take off wiper arm

Installation
Tighten wiper arm nut to specified torque*
Wait 15 minutes and try them again to specifi-
red torque*

33 61 012



Lift out retainers and remove cover



Unscrew nuts on both wiper shafts and
pull down on wiper linkage

33 61 018



Disconnect plug and lift out complete
wiper console.

33 61 014

* Refer to Specifications



Removing Wiper Motor
Unscrew bolts and nut

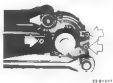
Note
Mark position of motor shaft to wiper
linkage (1) when reinstalling the same
motor

33 61 016



Installation
Connect motor briefly and try to reseat
portion (wipers parked) when installing a
new motor
Align parts 1 and 2 of wiper linkage that
they are in a straight line and then install
the motor

33 61 016



**Removing Wiper Contact Force Regulating
Motor**
Unscrew bolts and remove motor

Installation
Always only replace the wiper contact force
regulating motor complete, as precise ad-
justment is not possible. Exchange motors
are supplied adjusted.

33 61 017



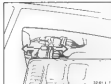
33 61 016

61 61 385 REMOVING AND INSTALLING OR REPLACING WIPER CONTACT PRESSURE CON- TROL MOTOR

Remove left and right wiper arms.
Unscrew left trim panel.

Unscrew screws.

Pull out plunger of contact pressure
control system with a magnet and hold
it with adhesive tape.



Disconnect white plug.
Unclip wires in holder on cover of
contact pressure control motor.

Remove wiper contact pressure con-
trol motor.
Cancel fault memory.
Check function after installation.



61-61/5



61 61 000 REPLACING WASHING FLUID TANK FOR HEADLIGHT CLEANERS

Drain tank

Lift out pump(s) with hoses and leads (shown on removed tank in picture for better understanding)

Unscrew screws and lift tank. Pull off leads on level switch and rib out tank.



12 61 028



62 61 027

61 61 REPLACING LEVEL SWITCH

Drain tank.

Unscrew screws, remove the level switch. Lift out switch.

Installation

Check that switch is positioned correctly

61 62 DESCRIPTION OF TAILGATE WASHER SWITCH OPERATION

The wiper has two modes of operation:

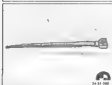
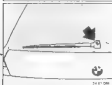
1. Intermittent function for tailgate window wiper.
2. Tip function, automatic washing of tailgate window.
Washing fluid is sprayed onto the tailgate window and the wiper is switched on.

Wiper operation is interlocked when the tailgate window is opened.
In the tailgate window lock, there is a relay switch which is operated by the lockpin of the tailgate window.
The washing function is accomplished with help of a stroke-type nozzle.



61-62/004 ADJUSTING WIPED ZONE OF TAILGATE WINDOW WIPER

Use the wiper run to parked position.
Parked position is wiper arm parallel to the heating strips.
Switch the wiper off.
Switch the ignition off.

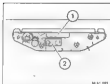


Unscrew screw.
Tightening wiper.
Correct the parked position.
Parked position is wiper arm parallel to the heating strips.
Check the function.
If it is not possible to adjust the wiped zone, the console of the tailgate window wiper must be adjusted.
Continue with the following steps.

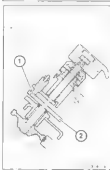


Open the tailgate window.
Unscrew cap of the wiper shaft mount.

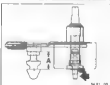
Refer to Specifications



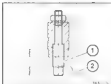
Parked position of wiper shaft mount.
Screw (2) must screw on step (1).



Side Section View of Assembly
1 Spring-loaded drainage in wiper shaft mount to take the wiper arm
2 Output shaft of wiper motor



Side View of Wiper Shaft Mount
Shown removed in this picture



Crankpin (1) must engage in output disk (2) of the output motor.

Important:

Crankpin (1) must not protrude beyond output disk (2).
Adjustments are made on the tension of the tailgate window lock.



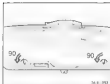
Remove the tailgate trim panel.
Unclip caps of screws.



Unclip cap of screw.



Unscrew screws.



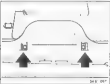
Open the tailgate.



Remove clips.



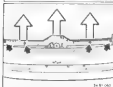
Unscrew left and right screws.



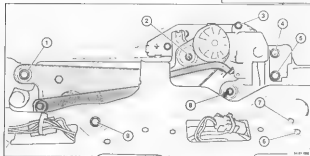
Unscrew screws.
Unscrew screws of the grip recess plate.



Shut the outgate.
Remove the motor crank cover.
Unscrew screw.



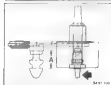
Take trim panel out of the clips carefully.
Remove the trim panel.



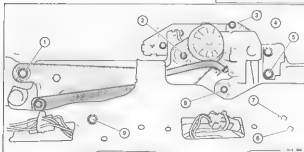
Unscrew screws of the console.
Shut the outgate window.

**Installation**

Lockpin (1) of the latigase window lock and crimpkin (2) of the wiper must engage in lock (3 and 4) of the latigase.



The lockpin of the latigase window lock must be adjusted to a depth distance ± 20.5 mm so that the crimpkin of the wiper arm will engage deep enough in the opening of the output disk.



Unscrew screws (1 - 8).

Shut the latigase window.

The lockpin should be adjusted to correct depth.

Tighten screws (1 - 8).

Tightening torque*

Check the elped zone

Check function



61-62/6-2 REMOVING AND INSTALLING - REPLACING TILLAGUE WINCH MOTOR

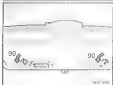
Remove the tillage winch panel.
Unclip caps of screws.



Unclip cap of screws.



Unscrew screws.



Open the toolboxes.



Remove clips.



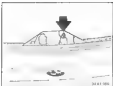
Unscrew left and right screws.



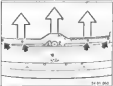
Unscrew screws.
Unscrew screws of the grip recess plate



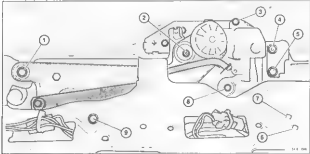
Strike the tillage winch.
Remove cap of the tillage winch.



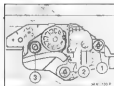
Unscrew screw



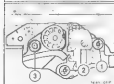
Take trim panel out of the clips carefully
Remove the trim panel



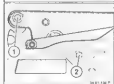
Unscrew screws (1 - 8) of the console



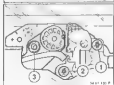
Installation
Long screw in rubber mount (11).



Wiper adjustments are made in the slots of the securing points.

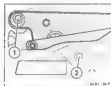


Console Screen
1 Long screw
2 Short screw



Important!
The screws with large washers must be used for rubber mounts (1 and 3).
Tightening torque*

* Refer to Specifications



Remove screws (1 and 2).
Tightening torque*



Lift wiper assembly out of the body
carefully.



Lower the wiper strap

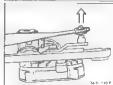


Disconnect the plug

* Refer to Specifications

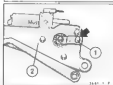


Lift wiper assembly out of the body completely.



General Wiper Assembly View

Lever the connecting rod out.

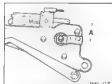


Pull the connecting rod off of the ball-headed pin.

Important!
Don't damage the ball-headed pin bearing in the connecting rod.



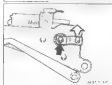
Move the crank position of motor crank (3) to wiper contacts (2).



Installation

Motor Crank Adjustment

Run the wiper motor to parked position.
Mount the wiper motor on the console.
Mount the motor crank.
Adjust distance (A) to 34 mm.
Tighten the motor crank.
Tightening torque*



Unscrew screw

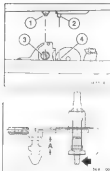
Lever the motor crank off.
Tightening torque*



Unscrew screws.
Tightening torque*

Installation

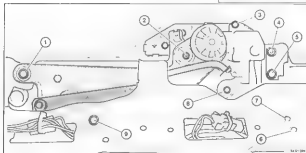
Adjust the wiped zone: refer to 61-62 (304)
Check the function



Installation

Lockpin (1) of the tailgate window lock and crankpin (2) of the wiper must engage in lock (3 and 4) of the tailgate.

The lockpin of the tailgate window lock must be adjusted to a depth (distance A) of 20.8 mm so that the crankpin of the wiper arm will **engage** deep enough in the opening of the output disk.



Unscrew screws (1 - 5)

Slide the tailgate window

The lockpin should be adjusted to correct depth.

Tighten screws (1 - 5).

Tightening torque*

Check the wiped zone.

Check function.

* Refer to Specifications

61-62 STEPS REMOVING AND INSTALLING CONSOLE (LARGE) FOR TAILGATE WINDOW WHEEL

Remove the tailgate trim panel.
Unclip caps of screws.

Unclip cap of screws

Unscrew screws.

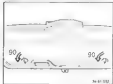
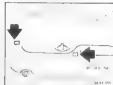
Open the toolbox.

Remove clips.

Unscrew left and right screws

Unscrew screws.
Unscrew screws of the grip recess plate.

Shut the tailgate.
Remove the motor crank cap

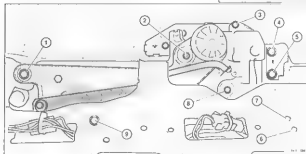




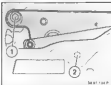
Unscrew below



Take front panel out of the clips carefully
Remove the front panel



Unscrew screws (1 - 9).



Console Screws

- 1 Long screw
- 2 Short screw

Important!

The screws with large washers must be used for rubber mounts (1 and 2).



Unscrew screws (1 and 2).

* Tightening torque*



Lift wiper assembly out of the body partially.

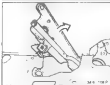


Loosen wire strap

* Refer to Specifications



Disconnect the plug



Lift wiper assembly out of the body completely.



Pull the drive nut off of the ball-headed pin.

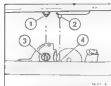
Important!

Don't damage the ball-headed pin bearing in the drive rod.



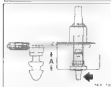
Unscrew the wiper motor screws. Remove the wiper motor.

* Refer to Specifications

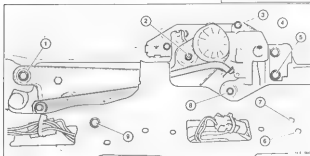


Installation

Lockpin (1) of the tailgate window lock and crankpin (2) of the wiper must engage in lock (3 and 4) of the tailgate.



The lockpin of the tailgate window lock must be adjusted to a depth distance A = 26.5 mm so that the crankpin of the wiper axis will engage deep enough in the opening of the output disk.



Unscrew screws (1 - 9).

Shut the tailgate window. The lockpin should be adjusted to correct depth.

Tighten screws (1 - 9).

Tightening torque*

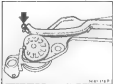
Check the wiped zone

Check function

* Refer to Specifications

61-62/STD REPLACING CONSOLE LINKAGE (1) FOR TAILGATE WINDOW WIPER

Refer to "Removing and Installing Console Linkage for Tailgate Window Wiper" in 61-62/32.



Unscrew Nut of Cable

Insulation
Replace the cable nut.



Inspection
Inspect the cable for damage.
If output disk (1) is damaged, it is absolutely essential to replace the cable in order to avoid pre-damaging the new console.



Unscrew the wiper motor screw.
Remove the wiper motor "tightening torque"

* Refer to Specifications

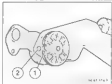


Locate the wire strap.

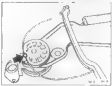


Cable installation

Work cable into drive rod (1)
Install nut (2) on the threads



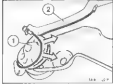
Adjusting installed position of Drive Disk.
Align the center of the attaching eye opening (1) with the center of rivet (2).



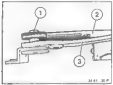
Place the cable eye in the drive disk



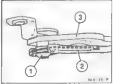
Routing of Cable on Drive Disk (1)



Place cable to drive disk (2)



Top View of Cable Routing on Drive Disk (3)

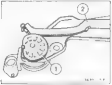


Insert the drive cable on drive disk (2) with help of the drive rod.

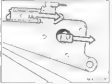
Important:
Don't damage the drive disk.



Cable Installed



Bring drive rod (2) into normal position



Run the motor to parked position (turn the motor on the console tightening torque)

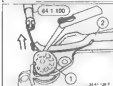


Remove the wire strap.

Installation Installing Wiper Assembly



Mount the drive rod on the motor bracket.



Adjusting Cable Tension.

Drive linkage attached.
Wiper in parked position.

Apply Special Tool 64 1 100 (scissors) on the
cable connection point.
Pull drive linkage (2) upwards vertically.



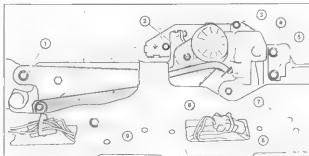
Ball (1) must be tightened in such a manner
that with a force of 30 N the clearance be-
tween the drive linkage and drive disk is
not more and also not less than 0.1 to 0.4
mm.



Installation
Lockpin (1) of the tailgate effective lock and
campin (2) on the wiper must engage in
lock (3) and (4) of the tailgate.



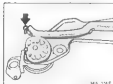
The lockpin of the tailgate window lock
must be adjusted to a depth distance of 4 ±
10 mm so that the campin of the wiper
arm will engage deep enough in the open-
ing of the output disk.



Unscrew screws (1) (2)
 Bend the support window
 The support should be adjusted to correct
 depth.
 Tighten screws (1) (2)
 Tightening torque*
 Check the wiring pins
 Check function

61-62-086 REMOVING AND INSTALLING REPLACING DRIVE ROD FOR TAILGATE WINDOW WIPER

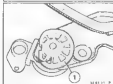
Refer to "Removing and Installing Console
Straps for Tailgate Window Wiper" in
61-62-075



61-62-086

Unthread nut of cable

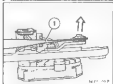
Inspection
Replace the cable nut



61-62-086

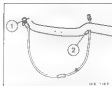
Inspection

Inspect the cable for damage.
If output drive (1) is damaged, it is absolutely
essential to replace the cable in order to
avoid pre-damaging the new console.



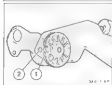
61-62-086

Lower drive rod (1) off the the ball-headed
pin of the motor crank.
Inspect the ball-headed pin of the motor
crank for damage.
Replace the drive rod



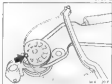
61-62-086

Work cable into drive rod (1).
Install nut (2) on the threads.



61-62-086

Adjusting installed Position of Drive Disk
Align the center of the attaching eye opening
(1) with the center of rivet (2)



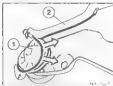
61-62-086

Place the cable eye in the drive disk.

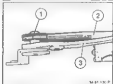


61-62-086

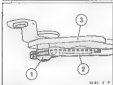
Routing of Cable on Drive Disk (1)



Place cable in drive disk (1).

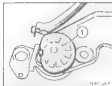


Top view of Cable Routing on Drive Disk (1)

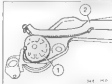


Install the drive cable on drive disk (1) with help of the drive rod

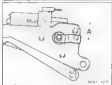
Important!
Don't damage the drive disk



Cable installed

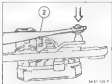


Bring drive rod (2) into normal position



Run the motor to parked position

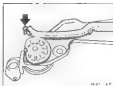
Distance A = 74 mm



Mount drive rod (2) on the ball-headed pin of the motor crank.
Install the wiper console.
Adjust the wiper zone - refer to 61-62/006
Check the function

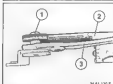
61-52-095 REMOVING AND INSTALLING - REPLACED CABLE OF DRIVE ROD FOR TAILGATE WINDOW

Refer to "Removing and Installing Console (Luggage) for Tailgate Window Wiper" in 61-52-079.

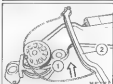


Unscrew nut of cable

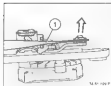
Installation
Replace the cable nut.



Precaution
It is absolutely essential to replace console (2). If cable roller (1) is damaged,



Disconnect cable (1) from drive rod (2).



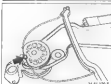
Lower drive rod (1) off the the ball-headed pin of the motor. Replace the drive rod.



Work cable into drive rod (1). Install nut (2) on the threads.



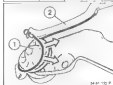
Adjusting Installed Position of Drive Disk
Align the center of the cable roller opening (1) with the center of drive (2).



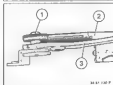
Place the cable eye in the drive disk.



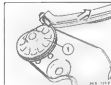
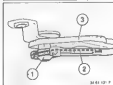
Routing of Cable on Drive Disk (1)



Place cable in drive disk (1)



Top View of Cable Routing on Drive Disk (1)

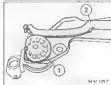


Install the drive cable on drive disk (1) with help of the drive rod (2).

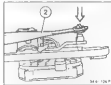
Important!
Don't damage the drive disk



Cable installed



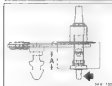
Bring drive rod (2) into normal position



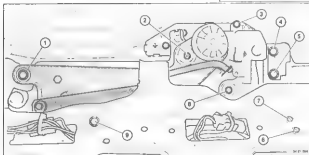
Mount drive rod (2) on the ball-headed pin of the motor crank inside the upper console



Insulation.
Lockpin (1) of the tailgate window lock and campin (2) of the rubber must engage in lock (3) and 4) of the tailgate.



The lockpin of the tailgate window lock must be adjusted to a depth distance A = 29.3 mm so that the campin of the rubber arm will engage deep enough in the opening of the output plate.



Unscrew screws (1) - 8).
Shut the tailgate window.
The lockpin should be adjusted to correct depth.
Tighten screws (1) - 9).
Tightening torque*

* Refer to Specifications



61-62 000 REMOVING AND INSTALLING REPLACING SHAFT MOUNT FOR FULL-DATE WINDOW WIPER

Operate the wiper to parked position.
Switch the wiper off.
Switch the ignition off.



Unclip cap on the screw.
Remove the wiper arm.
Unscrew screw.



Remove the outside shaft cover.



Unscrew screw.
Tightening torque*

* Refer to Specifications



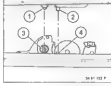
Unclip the inside cover.



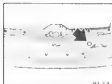
Unscrew screws.
Remove the shaft mount.



Install the shaft mount.
Locopin (1) must engage in striker (2).
Wiper crank (3) must engage in the output disk of wiper crank (4).



61-62 000



61-62-100 ADJUSTING WATER SPRAY NOZZLE FOR TAILGATE WINDOW

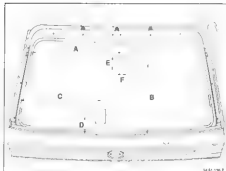
Shut the tailgate.
Move the water spray nozzle out



Hold the water spray nozzle tight in run out position.



Adjust the water spray nozzle in run out position using Special Tool 61-1-230.
Insert Special Tool 61-1-230 into the nozzle.
Mark point of contact with the tailgate window.



Adjustment Distances in mm

A	800
B	275
C	545
D	135
E	80
F	80

61-62 1-10 REMOVING AND INSTALLING REPLACING WATER SPRAY NOZZLE FOR TAILGATE WINDOW

Remove the tailgate trim panel.
Unclip caps on the screens.

Unclip cap on the screens.

Unscrew screens.

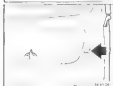
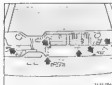
Open the screens.

Remove strips.

Unscrew left and right screws.

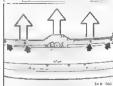
Unscrew screens.
Unscrew screws of the grip recess plate

Shut the tailgate.
Pull the cap off of the motor crank.





Unscrew screw



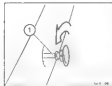
Take trim panel out of the clips carefully.
Remove the trim panel.



Shut the tailgate.
Pull the water spray nozzle out.



Hold the water spray nozzle tight in run-out position.



Hold right on telescopic rod (1) of the nozzle and unscrew the matched-color cap.

Important!
Don't scratch the painted cap.



Unscrew the painted nut using Special Tool ST 1 045.
"Tightening torque"

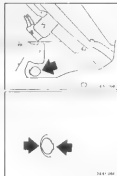


Place the tailgate.
Remove the water spray nozzle.



Loosen the hose clamp.
Remove the water spray nozzle.

* Refer to Specifications



Installation

The water spray nozzle is coated mechanically with a thin layer of oil so that it cannot be installed displaced by 180°.

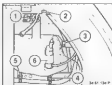
Adjust the water spray nozzle (refer to 61 62 1-10).
Fill the working fluid tank.

61-62 130 REPLACING WASHING FLUID TANK FOR TAILGATE WINDOW

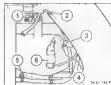
Remove the right rear side trim panel cover.
Empty the washing fluid tank.

61-65 130 REMOVING AND INSTALLING • REPLACING WASHING FLUID PUMP FOR TAILGATE WINDOW

Remove the right rear side trim panel cover.
Empty the washing fluid tank.



Loosen the hose clamp on split hose (1).
Pull the hose off.
Loosen the hose clamp on filler hose (3).
Pull the hose off.
Pull washing fluid pump (6) out of the tank.
Unscrew screws (1, 4 and 5).



Pull washing fluid pump (6) out of the tank.
Loosen the hose clamp.
Pull the hose off.
Disconnect the plug.
Check the rubber seal in the washing fluid tank for damage, replacing it if necessary.



Remove fluid level switch (7).
Remove the washing fluid tank.

Installation:
Fit the washing fluid tank.
Check the function.

Installation:
Fit the washing fluid tank.
Check the function.



61 67 REPLACING WASHING FLUID PUMP FOR HEADLIGHT CLEANERS

Disconnect air supply hose for the alternator – see Group 13.
Remove headlight cover – see Gr 63.

Empty supply tank.
Unscrew mounting springs.
Pull up tank, loosen hose clamp and pull off hose.

Remove pump.



61 67 645 ADJUSTING SPRAY JETS FOR HEADLIGHT CLEANERS

Spray Contact Point

Special Tool 00 9 100

ADJUSTING SPRAY JETS FOR FRONT FOG LAMPS

Spray Contact Point
Middle of fog lamp.

Special Tool 00 9 100



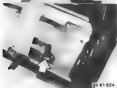
Important!
Hose must not be bent after installation.

61-67-090 Replacing spray nozzle for headlight cleaning system

Release screw and lift off finisher
Remove bumper, refer to Group 61



Detach retaining clip with screwdriver and lift
out line from spray nozzle.



Release nut and remove spray nozzle from
bumper

Adjusting spray nozzles
Connect BMW Service Tester
Simulate SRS status list outputs, and adjust
spray direction of nozzles with special tool
(00 09-130) connected. Refer to 61-17-040.

61 71 004 ADJUST WATER SPRAY NOZZLES FOR WINDSHIELD

The water spray should contact the windshield in the middle of the zone.
The dimensions are given for LHD models,
dimensions for RHD models are inverse.

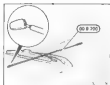
Adjustment distances in mm.

A1 = 310
A2 = 840

B1 = 443
B2 = 340

C1 = 460
C2 = 280

D1 = 330
D2 = 950



Mark the points of contact with pieces of tape.
Adjust the aiming of water spray nozzles
using Special Tool SD 8 200.



61-90. TROUBLESHOOTING DRIVE AND CONTROL UNIT FOR ELECTRIC SUN SHADE

Testing Requirements

Battery charged.

Fuse okay

Terminal B switched on both fusible

Test Step 1

Remove sun shade switch.

Pull switch off of wire harness plug

Measure voltage on wire harness plug
between pins 5 and 4

Specification: approx. battery voltage

yes Repair wires.

no

Measure voltage on wire harness plug
between pins 5 and 1

Specification: approx. battery voltage

no Repair wires

yes

Measure voltage between pins 5 and 2,
with term. B6 switched on

Specification: approx. battery voltage

no Repair wires for switch light

yes

Continue with Test Step 2.

Test Step 3

Check function of switch
Switch removed

Bridge (short) pins 3 and 4 on wire harness plug.
Sun shade runs up.

no . Continue with Test Step 4.

yes

Bridge (short) pins 3 and 1 on wire harness plug.
Sun shade runs down

no . Continue with Test Step 4.

yes

Continue with Test Step 3.

Test Step 3:

Check switch.
Switch released.

Measure resistance between pins 4 and 5. Switch pressed in run up direction.
Specification: approx. 0.2 ohm.

no Actual value > = > switch faulty

yes

Measure resistance between pins 1 and 3. Switch pressed in run down direction.
Specification: approx. 0.2 ohm.

no Actual value > = > switch faulty



Continue with Test Step 4

Test Step 4

Check leads from switch to 4-pin plug
on right C-pillar

Measure resistance of blue wire from
switch to 4-pin plug.
Specification: approx. 0.2 ohm.

no Actual value is - - check wire,
repairing if necessary

yes

-

Measure resistance of black wire from
switch to 4-pin plug.
Specification: approx. 0.2 ohm

no Actual value is - - check wires for
damage, repairing if necessary

yes

-

Continue with Test Step 5

61-90/5

Test Step 3

Check power supply of control unit

Four-pin plug on Optitrak disconnected.
Tested on wire harness and plug

Append: battery voltage on red/white
wire against car ground?

no - Check - repair wire and fuse

yes

+

Append: battery voltage between red/
white wire and brown wire?

no - Check - repair ground wire

yes

+

Continue with Test Step 4.

Test Step 6

Check control wire from switch to control unit

Plug in C-filter disconnected

Operate switch in run up direction
 Measure voltage on blue wire against
 car ground
 Specification approx. battery voltage

no _____ Check wire, repairing if necessary

yes

Operate switch in run down direction
 Measure voltage on black wire against
 car ground
 Specification approx. battery voltage

no _____ Check wire, repairing if necessary

yes

Continue with Test Step 7

Test Step 7

Check control unit power supply

Four-pin plug on C-pillar connected
Complete harness removed

Pull 3-pin plug off of control unit
Measure voltage on wire harness plug
between pin 3 and car ground.
Specification: approx. battery voltage

yes

+

Measure voltage between pins 3 and 3
Specification: approx. battery voltage

yes

+

Continue with Test Step 8.

no
• Repair 4-pin plug on C-pillar or wire
from plug on C-pillar to control unit

no
• Repair 4-pin plug on C-pillar or
ground wire from plug on C-pillar to
control unit.

Test Step 8:

Check control voltage from switch to control unit

Four-pin plug on C-pillar connected.
Five-pin plug on control unit disconnected.

Operate switch in open direction.
Measure voltage on 4-pin plug between pin 1 and car ground.
Specification: approx. battery voltage

no - Repair 4-pin plug on C-pillar or wire from plug on C-pillar to control unit

yes

Operate switch in close direction.
Measure voltage on 5-pin plug between pin 3 and car ground.
Specification: approx. battery voltage

no - Repair 5-pin plug on C-pillar or wire from plug on C-pillar to control unit

yes

Continue with Test Step 9

Test Step 3

Check output voltage of control unit

Five-pin plug connected

Four-pin control unit plug disconnected

Measure voltage on 4-pin control unit
plug between pin 1 and car ground.
Switch operated in run/stop direction.
Specification: approx. battery voltage

no Control unit faulty

yes

Measure voltage between pin 2 and car
ground.
Switch operated in run up direction.
Specification: approx. battery voltage

no Control unit faulty

yes

Continue with Test Step 10

Test Step 10**Check drive****Requirements**

Drive not seized mechanically

Drive removed from hutch for testing

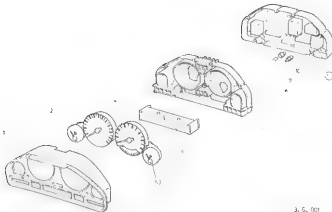
Supply 12 V power to drive direct on the plug

Drive functions?

Yes → Drive faulty

62 Instruments

	Overview of instrument cluster	62-	11/1
62 11	Instrument cluster – remove and disassemble	62-	11/2
070	Coding plug (plug in wiring harness) – replace	62-	11/4
070	Coding plug (plug in instrument cluster) – replace	62-	11/4
62 16 071	Signal generator – replace ...	62-	16/1
62 99	Lights in instrument cluster – replace	62-	99/1



3. 6. 001

- 1 Instrument center
- 2 Fuel gage
- 3 Speedometer
- 4 Tachometer and economy control
- 5 Temperature gage
- 6 LCD module

- 7 System center
- 8 Light bulb
- 9 Bulb holder
- 10 Socket lamp
- 11 Bezel plate

62 11 . REMOVING/DEASSEMBLING INSTRUMENT CLUSTER

Remove steering wheel - see 32 33 000

1. Pry out top of instrument cluster



Pry out top of instrument cluster slightly and pull forward up to the steering column. Then fold it down completely and

2. Pry out bottom of instrument cluster

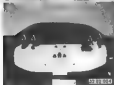
Note: Place a cloth on the steering column to avoid scratching the glass.



Press up levers next to the plugs and then pull off plugs.

3. Disconnect plugs

Levers must be positioned up when inserting the plugs.



(High Version)

Turn toggle screws 90° counterclockwise and fold up housing with electronic printed circuit board.



32 62 000

Pull both housing sections apart



32 62 000

Pull off knobs



32 62 007

Unscrew screws and pull instrument carrier off of the instrument carrier



32 62 006

Note

Make sure that the LCD module does not fall out while pulling off. Note spacers on the bottom screen.





12 30 60 90

Pull up pertinent gage carefully to replace it.

- 1 Fuel gage
- 2 Speedometer
- 3 Tachometer and economy control
- 4 Temperature gage
- 5 LCD module

(Standard Version)

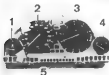
Unscrew screws and pull off system carrier on the instrument carrier



4 60 120

To replace, pull up pertinent instrument carefully

First loosen screws when removing the speedometer



4 60 120

- 1 Fuel gage
- 2 Speedometer
- 3 Tachometer and economy control
- 4 Temperature gage
- 5 Range display



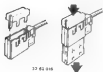
52 62 016

62 11 070 REPLACING CODING PLUG (Plug in Wire Harness)

Remove instrument cluster – see
62 11 060.
Remove back well on coding plug
carrier with a knife.

Insert unlocking tool (part of "coding
plug" repair kit) in carrier from behind
and press out the coding plug.

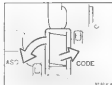
Slide replacement coding plug into
carrier from front until it engages.
Lock by sliding the replacement cover
(orange) on to the carrier from behind.



52 62 016



52 62 017

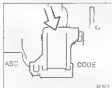


52 62 018

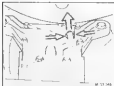
62 11 070 REPLACING CODING PLUG (Plug in Instrument Cluster)

Remove instrument cluster – see
62 11 060.
Cut out locking frame with a knife and
pull out coding plug.

Insert new coding plug and clip on
locking frame.



52 62 018



62-16/01 - REPLACED PULSE SENDER

Compress retainers and disconnect plug



Unscrew screws (1) and lift out pulse sender



Installation

Replace O-ring and dip it in or coat it with Molybdeum

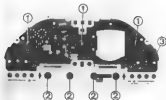
Slide O-ring on to speedometer sender

Shift only up to 10th phase (A)

Place sender with O-ring in rear axle and tighten both screws uniformly
"tightening torque"

62-99 REPLACING LAMPS IN INSTRUMENT CLUSTER

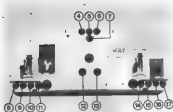
Removing instrument cluster - see 62-11



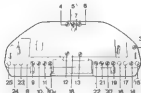
32 62 001

- 1 Lamp for instruments
- 2 Lamp for LCD module
- 3 ~~Throttle~~
- 4 Right turn signals
- 5 High beams
- 6 Left turn signals
- 7 Turn signals (trailer hitched)
- 8 SRS
- 9 ABS
- 10 Brake fluid level and brake pad wear
- 11 Parking brake
- 12 Engine oil pressure
- 13 Battery charge
- 14 Rear fog lights
- 15 Front fog lamps
- 16 Not used
- 17 Not used
- 18 ASC
- 19 Fuel Star
- 20 Not used
- 21 Preheating
- 22 Start engine
- 23 Fasten seat belts
- 24 Ride level height control
- 25 Electronic absorber control

(Standard Version)



31 62 002



34 62 001

63 Lights

63 10 004	Aiming headlights	63-	10/1
63 12 120	Left or right double headlight assembly complete with headlight camera – remove and install	63-	12/1
250	Headlight (for high beam), left or right – replace	63-	12/2
280	Headlight (for low beam) left or right – replace	63-	12/2
63 13 435	Actuator motor for headlight vertical aim control – replace	63-	12/3
	Left or right complete turn signal indicator lamp – remove and install	63-	0/1
63 17	Fog light, left or right – replace	63-	0/1
63 21	Tail light cluster, left or right – replace	63-	21/1
63 25 000	Auxiliary brake light – remove and install or replace	63-	25/1
63 26 000	License plate light, left or right – replace	63-	0/1
63 99	Bulbs in left or right headlight assembly – replace	63-	99/1
315	Bulbs in left or right tail light – replace	63-	99/2

63 10 094 Adjusting headlights

Test precondition

Check tire pressure and adjust if necessary. Load down driver's seat with one person (approx. 75 kg). Fuel tank full or additional weight in front. Park vehicle on level surface. A light adjusting device in longitudinal axis of vehicle and parallel to parking surface. A fixed marking line to dimension h (e.g. 12 cm/10 m) on aimer. The scale graduations on the aimer correspond to a gradient in h at a distance of 10 m. The figure shows a marking line on a vertical wall 10 m away from headlight glass lenses. The same figure is also provided in the adjusting device on an adjustable plate.

Adjusting procedure

For vertical adjustment, the light/dark boundary of the low-beam headlight must be aligned with the horizontal marking line of the adjusting device. For lateral adjustment, the United line must start below the center mark on the horizontal marking line. The center point of the high-beam headlight is adjusted to the center mark.

Key

$a = H - h = 12$ cm on vertical wall at 10-m distance, or adjustment value on aimer

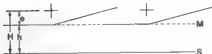
H = Height of headlight center point above parking surface

h = Height of marking line above parking surface

c = Central mark = Center point of headlights

M = Marking line

S = Parking surface



The headlight vertical arm is adjusted with screw (2) accessible from front grille.



Lateral adjustment takes place from the engine compartment (page 63 00).



High-beam is adjusted from the front, through the grille.

1 = Lateral adjustment
2 = Vertical adjustment



**63 12 130 REMOVING AND INSTALLING
LEFT OR RIGHT DOUBLE
HEADLIGHT COMPLETE
WITH CONSOLE**

Remove regulator grill - see 51 13 555
Turn clips 90°, lift out alternator vent
and pull out headlight cover from
above.



Pull off plug.



Unscrew screws.



Unscrew screws and remove headlight
with console.

83-12 250 REPLACING LEFT OR RIGHT
HEADLIGHT OR(HH BEAM)

Answered: 12/12/2019 12:12:12 PM



Heat plants: always with a hot air blower and 10% oil reflector

First insert plastic burnings on ball-head pins and then press head light on bushings.



1. *Horizontal displacement*
2. *Vertical displacement*



43.12 260 REPLACING LEFT OR RIGHT HEADLIGHT (LOW BEAM)

However, neither will = 0.000 000 12



Head plastic covered with a fog air
injection and 10 sec reflection

Installation
First insert plastic bushings on ball-head pins and then press headlight on bushings.



1. Lateral alignment
2. Vertical alignment

63-12-450-455 Removing and installing
or replacing headlight
vertical aim control

Remove front grille, refer to Group 63-12

Heat up plastic bush with hot air blower and
lift out ball head.

Note
Headlight installed. Shown on removed head-
light for better illustration.

Disconnect plug connection.
Turn actuator motor and lift out.



38 43 015

63-13/1



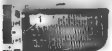
63-13 REMOVING AND INSTALLING LEFT OR RIGHT FRONT TURN SIGNAL ASSEMBLY

Pull off plug



Pull turn signal forward and take out of
holder on front side panel

63-17/1



63 17 REPLACING LEFT OR RIGHT FRONT FOG LAMP

Lift out cover of leveling eye.

Unscrew screw (1).
Remove front fog lamp and pull off plug.

Installation:
First attach front fog lamp on the side
and then tighten the screw.

Aiming:
Aim front fog lamps with a headlight
aimer by turning screw (2).



20-63 014

63 17 REPLACING ELLIPSOID LENS FOR FRONT FOG LAMP

Remove front fog lamp. see 63 17
Unscrew screws and take off lens

63 21 .. REPLACING LEFT OR RIGHT TAIL LIGHT ASSEMBLY

Turn clips 90° and lift them out.
Push back side trim panel.

Pull off plugs.
Unscrew nuts.
Lift out tail light assembly.

Lift out clips and lift trunk lid trim
panel.

Pull off plugs.
Unscrew nut.
Lift out tail lights.





63 25 000 Removing and installing or replacing auxiliary brake light

Lim

Turn lamp socket (front inward) and pull out



Remove rear window shelf refer to 51 45 000

Disconnect plug connection

Release screws and remove brake light

63 25 000 REPLACING LEFT OR RIGHT LICENSE PLATE LIGHT

Unscrew screws and remove light.

Put off plug.

Light bulb type*

* See Specifications



63 99 REPLACING LIGHT BULBS IN LEFT OR RIGHT HEADLIGHT ASSEMBLY

Turn clips 60 , 61 out alternator vent and pull out headlight cover from above



(High Beam Headlight)
Turn cap counterclockwise and take off



Pull off plug.
Open holder and remove light bulb

Never take hold of light bulb on glass

Light bulb type*

(Turn Signal)
Compress bulb holder on both clips and pull out (control rear)

Note:
Picture was taken on removed bulb holder.

Light bulb type*



(Low Beam Headlight)
Turn cap counterclockwise and take off



Pull off plug.
Open holder and remove light bulb

Note:
Never take hold of light bulb on glass

Light bulb type*



Turn and pull out bulb holder toward rear

(Parking Light)
Pull light bulb out of holder and install a new light bulb.

Note:
Light bulb type*



63 99 315 REPLACING LIGHT BULB(S) IN LEFT OR RIGHT TAIL LIGHT ASSEMBLY

Turn clip 90° and lift out.
Push back side trim panel.

Turn lamp socket counterclockwise
and lift out lamp socket with light bulb.

- 1 Turn signal
- 2 Stop light
- 3 Tail light

Apply

Permitted light bulb type will be found
on the lamp socket.

Lift out clips and lift trunk side trim
panel.

Turn lamp socket counterclockwise
and lift out lamp socket with light bulb.

- 4 Backup light
- 5 Rear fog light
- 6 Trunk light

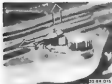
63 99 451 REPLACING LIGHT BULB FOR TRUNK LIGHT

Pull off lamp cover and lift out light
bulb.



64 Heating and air conditioning

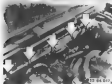
64 11 200	Heating system – remove and install (heating)	64- 11/1
205	Heating system – remove and install (air conditioning unit)	64- 11/2
207	Heater – replace (IHKA and IHKR)	64- 11/4
207	Heater – replace (HR)	64- 11/5
210	Heater fan – remove and install or replace	64- 11/6
	Splash wall – remove	64- 11/6
260	Auxiliary water pump – replace	64- 11/8
270	Valve insert for water valve – remove and install or replace	64- 11/9
271	Water valve – remove and install	64- 11/9
590	Output stage for fan – replace (IHKA, IHKR I)	64- 11/10
220	Resistance for fan motor – replace (HR, IHKR II and IHKR III)	64- 11/11
750	Operating unit – remove and install (heating and air conditioning HR, IHKR)	64- 11/11
750	Heater actuation – remove (automatic air conditioning system IHKA)	64- 11/12
61 31 561	Switch for fan – replace (heating)	64- 11/12
64 11 760	Control unit for heating control – replace (heating)	64- 11/12
765	Control unit for rear window – replace (air conditioning control)	64- 11/13
765	Control unit for heating and air conditioning – replace (IHKA, IHKR)	64- 11/14
775	Fan for interior temperature sensor – replace (only air conditioning control and automatic system)	64- 11/15
785	Printed circuit board for heating actuation – replace (only in automatic air conditioning system)	64- 11/15
	JED's – replace	64- 11/16
	One Bowden cable – replace (HR)	64- 11/17
...	Actuator motor – replace (IHKA, IHKR)	64- 11/17
933	External temperature sensor – replace	64- 11/18
939	Temperature sensor for heater, left or right – replace	64- 11/19
937	Condenser sensor – replace	64- 11/20
64 31 010	Microfilter – replace (heating)	64- 31/1
010	Microfilter – replace (air conditioning unit)	64- 31/2
	Function of refrigerant circuit (R12)	64- 50/1
	Service device (R12)	64- 50/2
64 50 009	Air conditioning unit – evacuate and fill (R12)	64- 50/3
	Air conditioner – suction-clean (R12)	64- 50/4
	Old refrigerator oil (R12) – drain	64- 50/4
	Air conditioner (R12) – discharge	64- 50/5
	System – fill	64- 50/6
	Leaks (R12) – detect	64- 50/6
	Refrigerant (R12) – clean	64- 50/7
	Troubleshooting using pressure measurement (R12)	64- 50/8
	Air conditioner – check efficiency (R12)	64- 50/9
	Function of refrigerant circuit (R134a)	64- 50/10
	Service device (SECU 134)	64- 50/11
009	Air conditioning system – evacuate and fill (R134a)	64- 50/12
	Air conditioner – suction-clean (R134a)	64- 50/13
	Old refrigerant – drain	64- 50/13
	Air conditioner (R134a) – discharge	64- 50/14
	System (R134a) – fill	64- 50/15
	Leaks (R134a) – detect	64- 50/16
	Refrigerant (R134a) – clean	64- 50/17
	Troubleshooting using pressure measurement (R134a)	64- 50/18
	Air conditioner – check efficiency (R134a)	64- 50/19
64 51 000	Evaporator – clean	64- 51/1
	Vehicles with IHKA	64- 51/1
	On vehicles with IHKR	64- 51/2
510	Evaporator – remove and install	64- 51/4
520	Expansion valve – remove and install or replace	64- 51/4
64 52	Valve core – remove and install	64- 52/1
020	Compressor for air conditioning system – replace (M20, M30)	64- 52/2
020	Compressor for air conditioning unit – replace (M50)	64- 52/3
020	Compressor for air conditioning unit – replace (M51)	64- 52/4
020	Compressor for air conditioning unit – replace (50)	64- 52/5
61 31	Temperature switch for compressor – replace	64- 52/6
64 52 061	Compressor coupling – replace (M20, M30, M50 with Vee belt)	64- 52/7
061	Compressor coupling – replace (on Seiki compressor)	64- 52/8
061	Compressor coupling – replace (on Nippondenso compressor)	64- 52/9
64 53 510	Dryer flask for air conditioning system – replace	64- 53/1
520	Safety pressure switch (high, medium, low pressure switch) – replace	64- 53/2
550	Condenser for air conditioning system – remove and install or replace	64- 53/3



20 64 015



20 64 016



20 64 017



20 64 018

64 11 200 REMOVING AND INSTALLING HEATER (Heating System)

Put the profile rubber part up.
Disconnect the plug and spill hose at the expansion tank.

524ml, 520l and 525l

Unscrew nuts on left and right sides of the expansion tank and lay the tank aside.

Note

Don't bend the coolant hose.

520l and 525l

If applicable, unscrew and lay the transverse cleaning fluid tank aside.

Cut the wire straps off.

Unscrew screws and pull the cover up.



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100

Disconnect heater hoses (7 - 9).

- 1 Water return
- 2 Water feed, right
- 3 Water feed, left

Important!

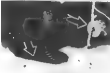
Store air into return pipe (1) of the heater to remove residual water from the heater core.



Unscrew screws



Unscrew screws and lift the left holder out.



Lift the left and right air ducts out
Remove the hoses

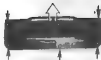
20 64 019

64-11-205 REMOVING AND INSTALLING

Expansion Tank

(Air Conditioning System)

Back refrigerant out of the air conditioner
 (refer to page 64-10-6 or operating manual
 for a pertinent sucking machine)
 Remove complete dashboard (refer to
 Group 51)



Unscrew screws and pull the cover up



Pull the profile rubber part up
 Disconnect the plug and split hose at the
 expansion tank



57445, 57446 and 57447
 Unscrew nuts on left and right sides of the
 expansion tank and lay the tank aside

Note
 Don't remove the O-rings

57448 and 57449
 If applicable, unscrew and lay the intertie
 cleaning fluid tank aside



Cut the wire straps off



Disconnect heater hoses (1 - 3)

- 1 Water return
- 2 Water feed, right
- 3 Water feed, left

Important!
 Blow air into return pipe (1) of the heater to
 remove residual water from the heater core



Unscrew nut,
 Tightening torque*
 Replace the O-rings



Unscrew screws

* Refer to Specifications

64-11/3



Unscrew screws and lift the left holder out



Lift the left and right air ducts out
Remove the heater



32-64-036

64-11/207 REPLACING HEATER CORE (DWA and BKR)

Remove center console and glowbox
refer to Group 81.
Disconnect heater hoses (1 - 3).

- 1 Water return
- 2 Water feed, right
- 3 Water feed, left

Important:

Blow air into intake pipe (1) of the heater to
remove residual water from the heater
core.

Installation:

Add coolant and bleed the cooling circuit
refer to Group 17.



32-64-037

Unscrew screws.
Lift the heater pipes out.

Installation:
Replace the O-rings.



32-64-039

Lift the heating core out from the right side.



32-64-040

Lift the front ventilation drive motor out
and pull plugs off of both heat exchanger
sensors.



32-64-050

Unscrew screws, loosen wire straps and
clamps, and remove the cover.

Installation:

Check for correct seating of the cover.

64-11 267 REPLACING HEATER CORE (HS)

Remove the dashboard trim panel at bottom left and the center console - refer to Group 31



Disconnect heater hoses (1 - 3)

- 1 Water return
- 2 Water feed, right
- 3 Water feed, left

Important!
Blow air into return pipe (1) of the heater to remove residual water from the heater core

Important!
Add coolant and bleed the cooling circuit refer to Group 17



Unscrew screws and lift the cover out.



Lift the heater core out

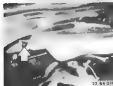


Unscrew screws and lift the heater pipes out.

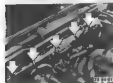
Note:
The heater remains installed (heater was removed for this picture only in the interest of better understanding).



22 64 015



22 64 016



22 64 017



22 64 018

64 11 210 Removing and installing or replacing fan for heating system

Remove splash well
S200, S200, S200.
Disconnect negative terminal battery.
Lift up rubber profile. If necessary,
remove plug and overflow hose on
expansion tank.

Unfasten hose on left and right sides of expansion tank and place tank to one side.

Do not bend coolant hoses.
S200, S200. If necessary, remove container for
extensive cleaning and place to one side.

Cut off wire straps.

Unfasten screws and lift off cover.



22 64 019

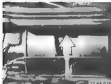


22 64 020

On heating system:
Remove fan.
Unfasten clips and remove cover.

Unfasten screws and lift up bracket.

Unfasten fan motor and remove plug.



On air-conditioning system:
 Remove splash wall, refer to 64-11 010
 Disconnect Sweden cable and unclip from cover
 Open plastic tab and remove cover



Put off plugs
 Lift off metal tab and remove tab.

The position of the fan motor is predetermined
 by the shape of the housing.

Caution!
 Do not remove or twist fan gears on motor
 shaft since the motor is balanced in a unit
 together with the fan gears



12 84 036

64 11 060 REPLACING ADDITIONAL WATER PUMP

Disconnect heater hoses (1 and 2).

Isolation:
Add coolant and bleed the cooling circuit
refer to Group 17



12 84 046

Loosen the clamp and unscrew screw
Remove the pump.



12 84 046

Disconnect the additional hose from the
additional water pump.

Version with Metal Upper Section

Disconnect the plug.
Unscrew nuts and lift the water valve out
together with the pump.



12 84 056

Version with Plastic upper Section

Disconnect the plug.
Unscrew nuts and lift the water valve out
together with the pump.



12 84 056



37 84 053

64 11 370 REMOVING AND INSTALLING REPLACING VALVE INSERT (SEE NOTE ON PAGE 64)

Only for Version with Metal Upper Section

Disconnect the plug and unscrew screws.

Unscrew screws and remove the cover.

Lift the complete valve insert out.



37 84 041



37 84 049



37 84 053



37 84 041



37 84 049



37 84 053

64 11 371 REMOVING AND INSTALLING WATER VALVE

Disconnect water hoses (2 and 3).

Installation
Add coolant and bleed the cooling circuit refer to Group 17

Disconnect additional coolant line additional water pump.

Version with Metal Upper Section:

Disconnect the plug.
Unscrew nuts and lift the water valve out together with the pump.

Version with Plastic Upper Section:

Disconnect the plug.
Unscrew nuts and lift the water valve out together with the pump.



64-11 001

64-11 010 REPLACE FINAL STAGE FOR BLOWER (PMSA and DMR 1)

Remove the gearbox - refer to Group 61
Unscrew screws.
Pull the trim panel forward out of the rear clips.



64-11 041

Pull the clip out and remove the cover



64-11 051

Unscrew screws and lift the air duct out



64-11 061

Disconnect all plugs on the control unit and final stage, and place the wire harness on top.

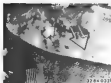


64-11 081

Unscrew screws and pull the final stage out

64 11 225 Replace resistance for left motor (part 6401 0 and 6401 0)

on HR
Remove glovebox and underside
trim, refer to 64-11



on 6401 0 and 0
Unscrew screws and remove trim on left side



Remove plug.
Twist apart clips and lift out resistance

64 11 750 Removing and installing operating unit, heating and air conditioning control unit (HR, 6401 0)

Remove radio panel or radio,
refer to 64-11



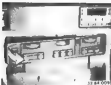
Reach through radio aperture and press
together clips on operating section, lifting out
operating section on left side



Press together counter-support, unclip and lift
out inner border cable on operating lever

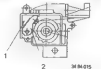


Disconnect plug.



64-11-750 REPAIRING HEATER CONTROLS (Automatic Climate Control IHCA)

Remove the rear window defogger switch cover. Insert a screwdriver (through the rear window defogger switch opening) and push the lock back. Lift the control unit out and disconnect the plugs.



64-31-501 REPLACING SWITCH FOR BLOWER (Heating System)

Remove the heater controls - refer to 64-11-750.
Unscrew screws and remove the blower switch.

Important!
Ensure that the catch lever (1) and spring (2) do not slide out while removing the blower switch.

64-11-760 REPLACING CONTROL UNIT FOR HEATING REGULATION (Heating System)

Remove the heater controls - refer to 64-11-750.
Remove the blower switch - refer to 64-31-501 above.
Unscrew screws and remove the heating regulation control unit.





64-11-785 Replacing control unit for rear window (air-conditioning controls)

Remove heating situation, refer to 64-11-750
 To remove the fan, slightly raise the clips on the cover and remove lid.



Press together clips and lift out cover



Remove plug and lift out fan assembly



Remove control unit together with Sweden cable unit.



Slightly raise clips on cable cover and lift off cover

64-11-011



Remove operating knobs.



64-11 785 Replacing control unit for heating and air-conditioning control (BRA, BRU)

Remove glovebox, refer to Group 61
unlabeled screws and remove trim from left and
right sides.



Remove screws and trim from control unit.



Remove plug from left side of control unit.



Remove all plugs on control unit and output
stage and place wiring harness on top.



Unscrew bolts
Remove trim by pulling away from rear clip.



Press down clips and lift control unit out on
right side.

Caution!
The new BRA parts of unit must be added;
refer to Information Diagnostic/Encoding



Remove clip and lift out cover

64-11 785



22-64-001



22-64-003

64-11-175 REPLACING FAN FOR INSIDE TEMPERATURE SENSOR (Only Air Conditioning System and Automatic Climate Control)

Remove the heater controls - refer to 64-11-170
To remove the sensor fan, lift the clips on the cover slightly and remove the cover

Disconnect the plug and remove the sensor



22-64-004



22-64-010



22-64-011



22-64-012

64-11-176 REPLACING PRINTED CIRCUIT BOARD FOR HEATER COIL (Only Automatic Climate Control)

Remove the heater controls - refer to 64-11-170
Remove the sensor fan - refer to 64-11-175
Unscrew screws and remove the cover

Push the retainer back on the pin and lever the pin out

Unscrew screws and remove the printed circuit board

Push the microswitch back while removing

Simply pull control wheels or buttons out upwards to replace them

Installation
Ensure correct position of the control wheel to the potentiometer



32-64-013



32-64-014

- Printed Circuit Board Connections:**
- 1 Microswitch temperature (driver)
 - 2 Microswitch fan
 - 3 Inside temperature sensor
 - 4 Potentiometer temperature (driver)
 - 5 Potentiometer fan
 - 6 Potentiometer temperature (from passenger)

- 7 Light bulb
- 8 Light emitting diodes



64-11 REPLACING LIGHT EMISSION

Check the installed direction and depth.
Bulb unscrewing.
Cathode is marked with a tab.

Distance A = approx. 12 mm

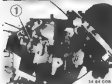
Make sure of good carrying off of heat into plate or heat sink while unscrewing and soldering.



14-64-016



14-64-017



14-64-018



14-64-019

64-11 REPLACING ONE CABLE (N/R)

Remove the radio speaker mask or radio refer to Group 65.
Squeeze the clip and lift the control panel out to the left.

Squeeze the clip of the concerned cable, lift it out of the counterholder and remove it from the nearest connector.

Remove the gearbox and bottom step panel - refer to Group 51.
Lift the internal cable out of the clip.
Squeeze clip (1) and remove the cable out of the holder.

The cables are adjusted automatically with a special clip by moving the control left to the left or right to stop.

1 = Special clip



14-64-010



14-64-011

Legend
Squeeze and remove only indicated parts from the illustration

- 1 = Red
- 2 = Blue
- 3 = Green
- 4 = Yellow

64-11 REPLACING DRIVE MOTOR (SHLA AND T-H/R)

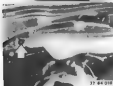
Disconnect the plug.
Press down on the retainer and lift the motor out.

Installation
Check for correct location of the stop.



64-11 830 REPLACING OUTSIDE TEMPERATURE SENSOR

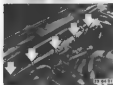
5241d, 5209 and 5251
Disconnect the battery ground lead.
Pull the profile rubber part up
Disconnect the plug and split hose at the
expansion tank.



Unscrew nuts on left and right sides of the
expansion tank and lay it aside.

Apply
Don't bend the coolant hoses.

5209 and 5251:
If applicable, unscrew and lay the intensive
cleaning fluid tank aside.



Cut the wire straps off.



Unscrew screws and pull the cover up.



Cut through the wire about 3 cm away
from the sensor and remove it along
the following line.



Install shrink-fit hose (1) and insulating
hose (2) on the wire.

Ensure that the soldered points are offset
against the wire.



Ensure that the soldered points are offset
against the wire.

Ensure that the soldered points are offset
(danger of short circuit)



Push insulating hose over the soldered
points.

64-11/19



13 64 019

Push the shutoff float over the wire and
shrink by heating with a hot air blower

64-11 800 REPLACING TEMPERATURE

REPLACING TEMPERATURE

Remove the control console - refer to 64- 21

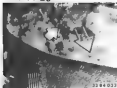


Disconnect the plug and fit the temperature
sensor

REPLACING

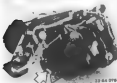
Shown in picture on a removed heater for
better understanding

64-11/20



64-11-507 REPLACING EVAPORATOR

Unscrew screw and pull off panel off of



Disconnect the plug and lift the evaporator
temperature sensor out.

Note

Shown in picture on a removed heater for
better understanding.



64-31-101-1

64-31-010 REPLACING MICROFILTER (Heating System)

Remove the glovebox refer to Group 31
Unscrew screws.
Pull the trim panel forward out of the rear clip.



64-31-101-2

Pull the clip out and remove the cover



64-31-041-1

Unscrew screws and lift the air duct out



64-31-041-2

Pull all plugs off of the control unit and place the wire harness on top.



64-31-071-1

Unscrew screws and remove the cover



64-31-071-2

Pull the microfilter out

Note
In R410 models the microfilter is split in length so that it can be pushed on to the steering column.



34 34 310 0

64 31 010 REPLACING MICROFILTER (Air Conditioning System)

Remove the glovebox - refer to Group 31
UnscREW screws.
Pull the inner panel forward out of the rear clip.



34 34 310 0

Pull the clip out and remove the cover.



34 34 310 0

UnscREW screws and lift the air duct out.



34 34 310 0

Put all plugs off of the control unit and
place the wire harness on top.

With Automatic Climate Control
Also pull plug off of the final stage.



34 34 310 0

With Automatic Climate Control
UnscREW screws and pull the final stage
out.



34 34 310 0

UnscREW screws (1), turn holder (2) about
90° and remove the cover.



34 34 310 0

Pull the microfilter out.

Note:
In RHD models the microfilter is split in
length so that it can be pulled on to the
steering column.

DESCRIPTION OF REFRIGERANT CIRCUIT FUNCTION R 12)

After switching on the air conditioner the refrigerant circuit is activated in that the solenoid clutch receives current. This produces pressure connections between the battery and pressure switch plate and the compressor is driven.

The compressor, a major component of the system, increases the pressure of refrigerant vapours. Refrigerant vapours are drawn in on the intake side of the compressor. The refrigerant is compressed, whereby the vapor temperature rises. The high pressure vapour passes via a high pressure pipe to a condenser located on the face of the engine radiator. The hot refrigerant is cooled off by wind from driving and an additional fan. Refrigerant vapors condense and turn into liquid when reaching the dew point temperature. The high pressure liquid refrigerant is delivered to the drier. The drier removes moisture from the refrigerant and sometimes also acids, but the latter only in the amount of 8 to 16 grams for R 12 or 10 to 16 grams for R 134 a systems.

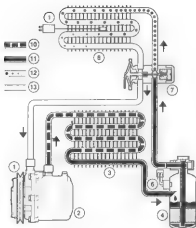
Refrigerant continues on to the expansion valve from the drier. The expansion valve makes up a point of separation in the system. The expansion valve meters the refrigerant volume of refrigerant is controlled by the temperature and pressure at the outlet of the evaporator. The refrigerant evaporates and cools off considerably in the evaporator. The fresh air - respectively circulated air - flowing past the cold evaporator, with stored energy is cooled accordingly and delivered into the passenger compartment via ducts.

The evaporated refrigerant is drawn in again by the compressor, whereby the refrigerant circuit is completed.

Moisture from the fresh or circulated air - flowing past the evaporator - condenses on the cold fins. The condensation on the evaporator is discharged outdoors via rubber hoses on the transmission tunnel and could cause a puddle of up to 200 ml underneath a parked car depending on the atmospheric moisture. This is completely normal and does not indicate a leak.

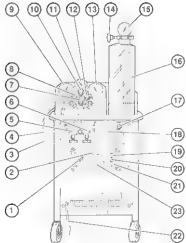
It could happen that the condensation water freezes on the fins of the evaporator. An evaporator temperature sensor prevents the formation of ice in that it switches the compressor off at 2 °C. The compressor is switched on again with a rising range of 1 °C. A safety switch, high or low pressure (pressure) switches the air conditioner off when pressure is too high or too low. This prevents damage to the air conditioner. A medium pressure pressure switch initiates the second stage of an addition fan on at a pressure of about 18 bar.

In this manner the compressor is not switched off and on so often, as the maximum high pressure is not reached so fast.



- 1 Solenoid clutch
- 2 Compressor
- 3 Condenser
- 4 Drier
- 5 Safety switches (high/low pressure pressure)

- 7 Expansion valve
- 8 Evaporator
- 9 Temperature switch
- 10 High pressure gas
- 11 High pressure liquid
- 12 Low pressure liquid
- 13 Low pressure gas



SERVICE STATION (S 10)

- 1 Main switch
- 2 Operation hour counter
- 3 High pressure hose
- 4 Low pressure hose
- 5 Refrigerant inlet valve
- 6 Refrigerant outlet valve
- 7 Vacuum pump valve
- 8 Low pressure valve
- 9 Low pressure gauge
- 10 Vacuum meter valve
- 11 Vacuum meter
- 12 High pressure valve
- 13 High pressure gauge
- 14 Charging cylinder inlet valve
- 15 Charging cylinder high pressure gauge
- 16 Charging cylinder with scale
- 17 Refrigerant drain valve
- 18 Moisture indicator
- 19 Control lamp - red
- 20 Control lamp - yellow
- 21 Control lamp - green
- 22 Power supply cord
- 23 Charging cylinder push button switch

64 50 000 DISCHARGING AND CHARGING AIR CONDITIONER (R 12)

Safety Precautions for Handling Refrigerant

The air conditioning system is filled with safety refrigerant R12 or R134a gradually as from the beginning of 1990.

Important!

R 12 and R 134a must never be mixed as even the most minute mixed quantities would lead to decomposition in the system. Consequently systems for R 12 may only be filled with R 12 and vice versa. Different refrigerants oils are used for both systems and must also not be mixed. Vehicles with R 134a systems as well as parts for replacements are marked. The service station for R 134a is green and marked R 134a. The service station for R 12 is blue.

R12 is very dangerous for the environment because of fluorchlorohydrocarbons (FCH) and must be drawn out, cleaned and refilled in a system with a service station. R12 or R 134a does not contain FCH, but it should also be drawn out, cleaned and refilled with a service station.

Although these refrigerants are non-toxic, non-flammable and non-explosive in any mixing ratio with air at normal temperatures, there must be compliance with safety precautions.

Avoid any contact with liquid or gas refrigerants. Wear goggles and gloves when working on the refrigerant circuit. Refrigerant on the skin will cause frostbite. Wash off contaminated parts of body with cold water thoroughly if refrigerant gets in the eyes, also draw out with water and then contact a physician immediately. Frigate a helmet than air and should it is gets into the atmosphere in spite of working with a service station, lead to asphyxiation - especially in working pits - which would not be readily noticed since the gas has no color or odor. Turn on available extraction systems.

Absolute cleanliness and as thorough as possible discharging of the air conditioner (at least 30 minutes) extraction of moisture from the refrigerant circuit are required for perfect air conditioner operation.

R12 or R 134a take on moisture very quickly. Plug opened pipes, condenser, evaporator, compressor or drier with plugs immediately.

Important!

Also in this case the plugs must not be mixed up and should be stored separately.

When replacing parts the plugs should be retrieved only immediately before connection of pipes.

In case of arbitrary damage, oil parts must be fitted with plugs so be able to determine the cause of damage.

If an air conditioner is completely drained because of leaks or accident, the drier must always be replaced as too much moisture will have entered the unit.

There should never be working on a filled air conditioner or in the close vicinity. There could be danger of an explosion because of the excessive pressure produced when refrigerant is heated.

In addition, refrigerants decompose at high temperature or when exposed to open flame. Decomposed products are injurious to health. Store hot refrigerant cylinders that they are not subjected to direct sunshine or other sources of heat (max. 45 °C).

Important!

After each refilling check protective caps of charging valves for handtight fit. They serve as additional seals.

The following procedures describe sucking, discharging and charging air conditioner with help of a SIECCU service station from the company "Bayer". Refer to pertinent operating instructions for changes in the service station design.

Prior to starting any operation the service station must be brought into basic setting. Basic setting means: A shut-off valves of the service station and both hose valves must be closed.

Important!

When using a different service station, refer to the pertinent operating instructions.



64-50 000

SUCKING REFRIGERANT OUT OF THE AIR CONDITIONER

Description of pressure gauge assembly

- 1 Low pressure hose (blue)
- 2 Refrigerant inlet valve
- 3 Sight glass
- 4 Low pressure valve
- 5 Low pressure gauge
- 6 Vacuum relief valve
- 7 Gas unit meter
- 8 High pressure gauge
- 9 High pressure valve
- 10 Vacuum pump valve
- 11 Refrigerant outlet valve
- 12 High pressure hose (red)

Bring service station into basic setting (refer to page 64-50/3).
 Connect service station to vehicle.
 Connect blue hose to low pressure side (thick pipe).
 Connect red hose to high pressure side (thin pipe).

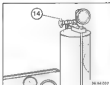
Pull back out the service station to ensure that there is no residual refrigerant in the service station.

Open valves (2, 4 and 6) and start the sucking operation.

After the service station has been switched off, the red control lamp lights up, with or note the volume of refrigerant in the charging cylinder (information is required for final setting to evaluate the system).

Open valves (1 and 3) on vehicle.
 This causes refrigerant to flow into the service station and the red control lamp goes out.

Operate start button again and suck refrigerant out of the entire system.
 The air conditioner system of the vehicle is empty when the service station is again switched off.



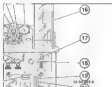
64-50 000

Bring service station into basic setting (refer to page 64-50/3).

Open valve (14) slowly until refrigerant flows into the service station. Start the sucking operation. Refrigerant is circulated (cleansed) in the service station. In this manner the complete refrigerant is converted into gas which has entered the oil trap. In liquid state during the sucking out operation. Close valve (14) again after about 10 minutes. The present volume can be read on the charging cylinder after the unit has switched off. Open valve (14) slowly until the red control lamp goes out.



64-50 000



64-50 000

Drain old refrigerant oil (5/12).

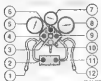
Open valve (17) slowly about 1/4 turn and drain the sucked out refrigerant oil into the measuring cup.

If there is no more oil in the oil trap, it will close automatically.
 Measure amount of drained refrigerant oil. Suck out system again afterwards and bring into basic setting.

Important!

If the oil running out flows very strongly, there is still liquid refrigerant in the oil. In this case the refrigerant must be cleaned again.

Never reuse drained refrigerant oil and dispose it as special refuse.
 The same amount of new refrigerant of plus 10 cm³ must be filled in the air conditioner after discharging.



34 64 001 01

DISCHARGING AIR CONDITIONER

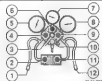
Bring service station into basic setting (refer to page 64-50/3).

Open valves (4, 5, 8 and 10).

Switch on vacuum pump. The only discharge the battery of pressure gauges. Maximum possible vacuum is reached after about 1 to 3 minutes. The needle of vacuum meter (7) must then be above or below the zero. This strongly depends on current weather conditions. In high pressure weather zones the maximum possible vacuum will be lower than in deep pressure weather zones. The battery of pressure gauges has a leak if the zero point is not approximately reached or vacuum is not built up.

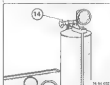
Close valve (11) and switch off vacuum pump after reaching maximum vacuum. The battery of pressure gauges does not leak. If the pressure does not rise after about 1 to 3 minutes.

Afterwards set needle of vacuum meter (7) to zero (with adjusting screw on top of the vacuum meter) and close valve (5).



34 64 001 01

Switch on vacuum pump and using the suction pipe suck the previously measured amount of new refrigerant oil out of the measuring cup into the system. Switch off vacuum pump as soon as the total amount of oil is in the system, in order to avoid sucking in "foam" of refrigerant. High pressure hose to connection (12) and open valve (8). Switch off vacuum pump again and discharge system at least 30 minutes.



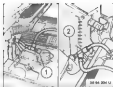
34 64 001 01

The previously sucked out refrigerant can be cleared simultaneously in the discharging process.

This requires opening valve (14) slightly (1 to 1/2 turns) and switching on suction.

Important:

Stop the clearing process after about 10 to 15 minutes. Discharging air runs.



34 64 001 01

Open valves (1 and 3) slowly.

Then discharge the air in system slowly.



34 64 001 01

After discharging, close valve (10) and switch off vacuum pump.

There is no longer vacuum in the system. If the needle of vacuum meter (7) remains at 0 over a period of at least 3 to 5 minutes. However, if the needle rises in small jumps this is indication of water drops which are evaporating and causing the pressure to rise. In such a case discharging must be continued.

Close valve (9) and switch vacuum pump off.

Unscrew high pressure hose from pressure gauge assembly and connect to the supplied suction pipe.



34 64 001 01

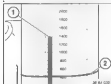
Filling the system

Prerequisites for correct charging are sufficient refrigerant as well as pressure in the charging cylinder. If there is not enough refrigerant in the charging cylinder, this must be compensated by sucking refrigerant out of the pressure cylinder. Insufficient pressure can be increased by switching on the charging cylinder heater or by evacuating the refrigerant.



Adjust service station to basic setting.
Open valves (4 and 6).
Open valve (1) briefly and close again so that refrigerant can flow up to the filter hoses.

20.5-1 208-1



Read charging cylinder level (1), subtract specified fill quantity* from this value and mark new volume level with a rubber band (2).



Open valves (1) and (2) on the filling hoses.
Then open valve (1) again and observe the level in the charging cylinder. If there is an approximately correct filling volume* in the system, close and open valve (1) 4 steps until the correct volume is in the system.

* Refer to Technical Data

20.5-1 208-1



Detecting Leaks (P. 12)

In the vacuum leak test it is possible for leaks not to be detected at loose pipe connections because (these might be pressed) against the sealing surface, thus preventing them from leaking. Consequently leak detection is absolutely essential after filling the system. If leaks are determined while discharging the system, the system must be filled with about 200 to 300 grams of refrigerant.

Afterwards replace leak detector (7)* according to the opening instructions.
Check air conditioner for leaks with leak detector (1).

Tighten loose pipes and mark location of leaks (rubline).

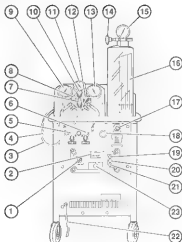
Switch out refrigerant, alternate tests and discharge again. If no leakage is detected, the system must be filled with the specified volume of refrigerant. Run the engine, adjust the air-conditioning unit as for the A/C performance measurement to ensure that the pressure in the system rises to approx. 12 to 15 bar. Then switch off the engine and repeat the leak examination (starting on the pressure side).

Note

Always check below in assumed point of leakage on pipes and components as refrigerant is heavier than air.

* Refer to Technical Data

** Refer to Workshop Equipment and Planning Documentation



CLEANING REFRIGERANT (P. 12)

Bring service station into basic setting (refer to page 64-50/7).

Open valve (14) on charging cylinder slightly (1 to 1.5 turns).

Switch on suction and let cleaning run at least 10 minutes.

Close valve (14) and wait until the compressor is automatically switched off.

In the cleaning process the refrigerant is pumped through a drier integrated in the service station where it is dried and cleaned to remove particles of dirt. A moisture indicator (18) shows the refrigerant is moisture content. Cleaning time should not exceed 10 to 15 minutes. If the moisture indicator still shows moisture after this time, the drier is saturated and must be replaced (refer to operating instructions of the service station). Afterwards the refrigerant must be cleaned again.

If the compressor is switched on during the cleaning process, the reasons for this could be as follows:

- 1 Insufficient evaporative pressure in back of the compressor

This is applicable, if the charging cylinder valve is opened too fast or too much.

The same pressure can be read on pressure gauge (13) during the cleaning phase by opening valve (14).

- 2 Excess of pressure (> 17 bar) in charging cylinder

This means non-condensable gas in the circuit. In this case close valve (14) and discharge the non-condensable gas via the Schrader valve on the charging cylinder. If there is no gas in the charging cylinder and the pressure is still too high, wait until the refrigerant in the charging cylinder has reached ambient temperature.

Afterwards switch on cleaning again until the moisture indicator no longer indicates moisture. Then close valve (14) and wait until the compressor switches off automatically.

TROUBLESHOOTING BY MEASURING PRESSURE (A 13)

Connect service station to car and open both valves on the charging hoses. Adjust air conditioner on the control unit to such a manner as described for measuring air conditioner efficiency (refer to page 64-50/9). Run engine of car at approx 1,500 rpm.

High inlet and outlet pressures indicate an overcharged system, contaminated condenser or defective additional fan.

Remedy
Suck out refrigerant, discharge and re-charge system, clean condenser and check additional fan, replacing if necessary.

High inlet pressure and normal outlet pressure indicate a defective compressor.

Remedy
Replace compressor.

Compressor does not run with equal inlet and outlet pressures.

Remedy
If bring-up processor has switched the compressor off, check evaporator sensor or check power supply to the magnetic coupling (refer to Electro/Electronic Test for Group 64). Otherwise check magnetic coupling mechanically (A101).

Low inlet pressure and normal outlet pressure indicate an insufficient charged volume or restricted low pressure side of the system.

Remedy

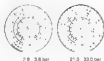
1. Check whether evaporator has ice, then check evaporator sensor.
2. Suck out and measure refrigerant. If sucked out volume is approximately the same as specified charge volume*, check flow of expansion valve, then discharge and recharge system.

Low inlet pressure and high outlet pressure indicate a restricted high pressure side.

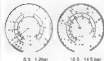
Remedy

Check condenser, drier and expansion valve.

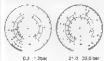
* Refer to Specifications.



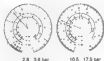
32 bar 142.7



12 bar 144.7



32 bar 142.7



32 bar 142.7



32 bar 142.7

CHECKING AIR CONDITIONER EFFICIENCY (R 12)

The following conditions must be fulfilled for this test:

1. Modic or BMW Service Tester
2. Thermometer
3. Inside air temperature of about 50 °C

Ref. Point 1

Connect Modic or BMW Service Tester to car and have the evaporator temperature displayed.

Ref. Point 2

Install temperature sensor approx. 5 cm below the car's roof liner at height of B-pillar and locate the display unit outside.

Ref. Point 3

Set heater to maximum heating. Switch on and set air conditioner to circulated air mode. Set car's blower to speed step 4 or maximum speed. Shut all windows and doors. Start and run engine at approx. 2.000 rpm. Use a pedal prop to accelerate in cars with I ML, GDE or M60 engine.

Afterwards heat up the passenger compartment to about 50 °C. The compressor must be longer switch on. Now measure the passenger compartment temperature and evaporator temperature and subtract the values from each other. There should be a difference of about 40 °C.

If this difference in temperature is not reached, connect the service station. Measure the low pressure and high pressure and compare with troubleshooting by means of a pressure test (refer to page 64 50/8).

DESCRIPTION OF REFRIGERANT CIRCUIT FUNCTION (34a)

After switching on the air conditioner the refrigerant circuit is activated in that the magnetic coupling receives current. This produces positive connection between the pulley and pressure clutch pump and the compressor is driven.

The compressor – a major component of the system, increases the pressure of refrigerant vapors. Refrigerant vapors are drawn in on the intake side of the compressor. The refrigerant is compressed, whereby the vapor temperature rises. The high pressure vapors pass via a high pressure pipe to a condenser located on the back of the engine radiator. The hot refrigerant is cooled off by wind from driving and an additional fan. Refrigerant vapors condense and turn into liquid when reaching the dew point temperature. The high pressurized refrigerant is delivered to the drier. The drier removes moisture from the refrigerant and sometimes, sulphuric acid, but the upper limit is the amount of 5 to 10 grams in R 12 systems or 10 to 15 grams in R 134a systems.

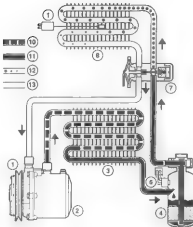
Refrigerant continues on to the expansion valve from the drier. The expansion valve makes up a point of separation in the system. The expansion valve meters the refrigerant and volume of refrigerant is controlled by the temperature and pressure at the outlet of the evaporator. The refrigerant evaporates and flows off consistently in the evaporator. The fresh air – respectively circulated air – flowing past the cold evaporator with blower motor is cooled accordingly and delivered into the passenger compartment via ducts.

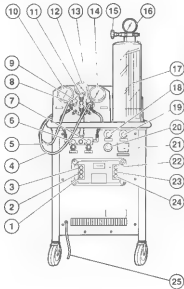
The evaporated refrigerant is drawn in again by the compressor, whereby the refrigerant circuit is completed.

Mixing from the fresh air circulated air – flowing past the evaporator – condenses on the condenser. The condensation on the evaporator is discharged outdoors via rubber hoses on the transmission tunnel and could cause a puddle of up to 200 ml of water in a parked car depending on the atmospheric moisture. This is completely normal and does not indicate a leak.

It could happen that the condensation water freezes on the fins of the evaporator. An evaporator temperature sensor prevents the formation of ice in that it switches the compressor off at 2 °C. The compressor is switched on again with a reversing range of 2 °C. A safety switch (high or low pressure presensors) switches the air conditioner off when pressure is too high or too low. This prevents damage to the air conditioner. A medium pressure presensor switches the second stage of an additional fan on at a pressure of about 18 bar.

In this manner the compressor is not switched off and on so often, as the maximum high pressure is not reached so fast.





SERVICE STATION (REDU 124)

- 1 Main switch
- 2 SUCTION/CLEANING switch
- 3 SUCTION and control temp
- 4 High pressure hose
- 5 Low pressure hose
- 6 Refrigerant filler valve
- 7 Refrigerant outlet valve
- 8 Vacuum pump valve
- 9 Low pressure valve
- 10 Low pressure gauge
- 11 Vacuum meter valve
- 12 Vacuum meter
- 13 High pressure valve
- 14 High pressure gauge
- 15 Charging cylinder valve
- 16 Charging cylinder with scale
- 17 Refrigerant oil filler valve
- 18 Refrigerant oil drain valve
- 19 Moisture indicator
- 20 Measuring cup
- 21 VACUUM PUMP switch
- 22 Red control lamp
- 23 HEATER switch
- 24 Power cord

64 50 006 DISCHARGING AND CHARGING AIR CONDITIONER (R 134a)**Safety Precautions for Handling Refrigerant**

The air conditioning system is filled with safety refrigerant R134a or R134a systems gradually as from the beginning of 1994

Important!

R 12 and R 134a must never be mixed as even the most minute mixed quantities would lead to decomposition in the system. Consequently systems for R 12 may only be filled with R 12 and vice versa. Different refrigerant is used for both systems and must also not be mixed. Vehicles with R 134a systems as well as parts for replacements are marked. The service station for R 134a is green and marked R 134a. The service station for R 12 is blue.

R134a is very dangerous for the environment because of fluorochlorocarbons (FCKW) and must be drawn out, cleaned and refilled in a system with a service station. R134a does not contain FCKW, but it should also be drawn out, cleaned and refilled with a service station.

Although these refrigerants are non-toxic, non-flammable and non-explosive in any existing ratio with air at normal temperatures, there must be conformance with safety precautions.

Avoid any contact with liquid or gas refrigerants. Wear goggles and gloves when working on the refrigerant circuit. Refrigerant on the skin will cause frostbite. Wash off contaminated parts of body with cold water thoroughly. If refrigerant gets in the eyes, also rinse out with water and then contact a physician immediately. R134a is heavier than air and could, if it gets into the atmosphere, in spots of working with a service station, lead to asphyxiation - especially in working pits - which would not be readily noticed since the gas has no color or odor. Turn on available extraction systems.

Absolute cleanliness and as thorough as possible discharge of the air conditioner (at least 30 minutes extraction of moisture from the refrigerant circuit) are required for perfect air conditioner operation.

R134a R 12 and even more up to R 134a take on moisture very quickly. Plug opened pipes, condenser, evaporator, compressor or other with plugs immediately.

Important!

Also in this case the plugs must not be mixed up and should be stored separately.

When replacing parts the plugs should be removed only immediately before connection of pipes.

In case of warranty claims, old parts must be filled with plugs to be able to determine the cause of damage.

If an air conditioner is completely drained because of leaks or accident, the ester must always be replaced as too much moisture will have entered the unit.

There should never be welding on a filled air conditioner or in the close vicinity. There could be danger of an explosion because of the excessive pressure produced when refrigerant is heated.

In addition, refrigerants decompose at high temperatures or when exposed to open flame. Decomposed products are injurious to health.

Secure the refrigerant cylinders that they are not subjected to direct sunshine or other adverse conditions (max. 45 °C).

Important!

After each refilling check protective caps of charging valves for handtight fit. They serve as additional seals.

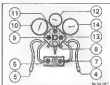
The following procedures describe sucking, discharging and charging air conditioners with help of a SLECU 134 service station from the company "Bairr".

Refer to pertinent operating instructions for changes in the service station design.

Prior to starting any operation, the service station must be brought into basic setting. Basic setting means: A. shut-off valves of the service station and both hose valves must be closed.

Important!

When using a different service station, refer to the pertinent operating instructions.



SUCKING REFRIGERANT OUT OF AN AIR CONDITIONER (0.13kg)

Description of pressure gauge assembly

- 4 High pressure hose (red)
- 5 Low pressure hose (blue)
- 6 Refrigerant inlet valve
- 7 Refrigerant outlet valve
- 8 Vacuum pump valve
- 9 Low pressure valve
- 10 Low pressure gauge
- 11 Vacuum meter valve
- 12 Vacuum meter
- 13 High pressure valve
- 14 High pressure gauge

Bring service station into basic setting

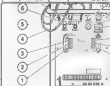
(refer to page 64-50/12).

Connect service station to vehicle.

Connect blue hose to low pressure side (thick pipe).

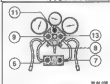
Connect red hose to high pressure side (thin pipe).

The quick-action couplings are different in diameter to avoid mixing them up.

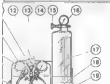
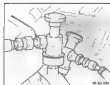


Switch on service station using main switch

(1). Switch on suction after white control lamp (2) has gone out. Suction is switched on automatically if entire refrigerant has been sucked out of the service station. Write down or note volume in the charging cylinder.



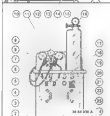
Open valves (8, 9 and 13). This causes refrigerant to flow into the service station and the white control lamp goes out.



Open valves on the quick-action couplings. Start suction again and suck out entire system until the unit is switched off again.

Bring service station into basic setting (refer to page 64-50/12).

Open valve (18) slowly until refrigerant gas flows into the service station. Switch on suction. Refrigerant is circulated (circled) in the service station. This converts entire refrigerant into gas which had entered the oil trap in liquid state during suction. Close valve (18) again after about 10 minutes. Read volume in charging cylinder from scale (17) after unit has switched off and write down or note value (required for evaluation of system during troubleshooting).



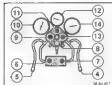
Drain old refrigerant oil.

Open valve (18) slowly until white control lamp (3) goes out. Open valve (16) slowly about 1-4 turn and drain the sucked out refrigerant off into the measuring cup. If there is no more oil in the oil trap, it will close automatically. Measure amount of drained refrigerant oil. Close valve (18) again. Suck out service station again afterwards.

Important!

If the oil running out flows very strongly, there is still liquid refrigerant in the oil. In this case the refrigerant must be cleaned again.

Never reuse drained refrigerant oil and dispose it as special refuse. After discharging the system must again be filled with the same amount of new refrigerant oil plus 10 cm³.



DISCHARGING AIR CONDITIONER R 134a

Bring service station into basic setting (refer to page 64-50/13).

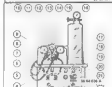
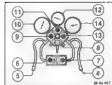
Open valves (8, 9, 11 and 13).

Switch on vacuum pump. This only discharges the pressure gauge assembly and charging hoses up to the quick-action couplings.

Maximum possible vacuum is reached after about 1 to 2 minutes. The needle of vacuum meter (12) must then be above or below the zero. This strongly depends on current weather conditions. In high (partial) sun weather zones the maximum possible vacuum will be lower than in deep (partial) weather zones. The pressure gauge assembly (or charging hoses) will be at the zero point if the zero point is not approximately reached or vacuum is not built up.

Close valve (6) and switch off vacuum pump after reaching maximum vacuum. Pressure gauge assembly and charging hoses do not leak if the pressure does not rise after about 1 to 2 minutes.

Adjusters set needle of vacuum meter (12) to zero (with adjusting screw on top of the vacuum meter) and close valve (11).



If the pressure has risen, open valve (6). Switch on suction again until the unit is again switched off.

Close valve (6) and open valves (8 and 11). Switch on vacuum pump and discharge the air conditioner at least 10 minutes.

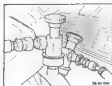
Refrigerant in the service station can be cleaned automatically by the discharging process. This is only necessary when moisture indicator (20) indicates moisture. This involves opening valve (10) slightly (1 to 1.5 turns) and switching on suction.

Important

Stop the clearing process after about 10 to 15 minutes by closing valve (10).

Discharging still runs.

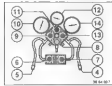
If indicator (20) still indicates moisture after the clearing period, discharging must also be interrupted and the drier in the service station replaced (refer to operating instructions of service station).



Open the valves slowly

Important

If this causes a rise in pressure in gauges (10 and 14), the system must be sucked out again. Pressure can only rise if the air conditional is not opened, but only refrigerant was sucked out for troubleshooting. The pressure rise is caused by conversion of small residual amounts of liquid refrigerant into gas in the system.



After discharging, close valve (6) and switch off vacuum pump.

There is no longer moisture in the system if the needle of vacuum meter (12) remains at 0 over a period of at least 3 to 5 minutes. However, if the needle rises in small jumps this is indication of moisture which is evaporating and causing the pressure to rise. In such a case discharging must be continued.

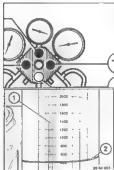
The system leaks if the needle rises continuously. In this case the leak must be eliminated (refer to detecting leaks on page 64-50/14).

CHARGING SYSTEM (R134a)

Requirements for correct charging are a sufficient amount of refrigerant and pressure in the charging cylinder of at least 9 to 11 bar. If there is not enough refrigerant in the charging cylinder, this must be compensated by sucking refrigerant out of the pressure cylinder. Insufficient pressure can be increased by switching on the charging cylinder heater. Check whether the refrigerant is dry on the moisture indicator. If not, clean the refrigerant - refer to page 64-50/17.

Important!

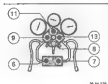
Charging must be carried out exclusively via the red high pressure hose.



Bring the service station into basic setting (refer to page 64-50/12).

Open valve (2) briefly and close again so that refrigerant can reach the red charging hose.

Read charging cylinder volume (1), subtract the specified volume* from this value and mark this charging volume level with rubber band (2).



34 429 020

Open valve on red charging hose. Then open valve (7) again and observe charging volume level in the charging cylinder.

If the system has approximately the specified charge volume*, close and open valve (7) in brief steps until the system has the specified charge volume.

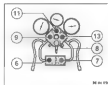
Close valve on red charging hose. Open valves (8, 9 and 13) and switch on suction.

This sucks refrigerant out of the hose and service station.

If the unit switches off, charging has been completed and charging hoses can be disconnected from the vehicle.

Refrigerant

Insert sealing caps in the vehicle's connection again.



34 429 020

* Refer to Specifications

* Refer to Specifications



Detecting Leaks (R 134a):

In the vacuum leak test it is possible for leaks not to be detected at loose pipe connections as these might be pressed against the sealing surface, thus preventing them from leaking. Consequently leak detection is absolutely essential after charging the system. If leaks are detected while charging the system, the system must be filled with about 200 to 300 grams of refrigerant.

Afterwards calibrate leak detector (1)^{*)} according to the operating instructions.

Check air conditioner for leaks with leak detector (1).

Tighten loose pipes and mark location of leaks (hairline).

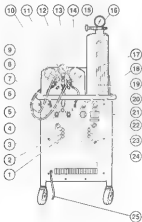
Recharge refrigerant, eliminate leaks and recharge again. If no leaks are detected, the system should be filled with the specified volume of "refrigerant". Start the engine and adjust the air-conditioning unit so that the A/C performance measurement so that the pressure in the system rises to approx. 12 to 18 bar. Then switch off the engine and repeat the leak examination (Starting on the pressure side).

Notes

Always check below each assumed joint of leakage in pipes and components because refrigerant is heavier than air.

^{*)} Refer to Technical Data

^{**)} Refer to Workshop Equipment Piping



CLEANING REFRIGERANT (R 134a)

Bring service station into basic setting (refer to page 64-50/15).

Open valve (15) on charging cylinder slightly (1 to 1 1/2 turns).

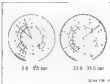
Switch on suction (2) and let cleaning run at least ten minutes.

Close valve (15) and wait until control lamp (25) lights up and the compressor is automatically switched off.

In the cleaning process the refrigerant is pumped through a drier integrated in the service station where it is dried and cleaned to remove particles of dirt. A moisture indicator (20) shows the refrigerant's moisture content. Cleaning time should not exceed 10 to 15 minutes. If the moisture indicator still shows moisture after this time, the drier is saturated and must be replaced (refer to operating instructions of the service station). Afterwards the refrigerant must be cleaned again.

If the compressor is switched off during the cleaning process, the reasons for this could be as follows:

- 1 Insufficient excessive pressure or intake of the compressor. This is applicable, if the charging cylinder valve is opened too little or too much.
- 2 Excessive pressure > 17 bar in charging cylinder. This means non-condensable gas in the circuit. In this case close valve (15) and discharge the non-condensable gas via the Schrader valve on the charging cylinder or wait until refrigerant in the charging cylinder has reached ambient temperature. Afterwards switch on suction until there is no longer refrigerant in the service station and the compressor is switched off automatically.



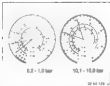
TROUBLESHOOTING BY MEASURING PRESSURE (R 134a)

Connect service station to car and open both valves on the charging hoses. Adjust air conditioner on the control unit in such a manner as described for measuring air conditioner efficiency (refer to page 64-50/16). Run engine at idle at approx. 1,000 rpm.

High inlet and outlet pressures indicate an overcharged system, contaminated condenser or defective additional fan.

Remedy

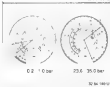
Suck out refrigerant, discharge and re-charge system, clean condenser and check additional fan, replacing it necessary.



Low inlet pressure and normal outlet pressure indicate an insufficient charged volume or restricted low pressure side of the system.

Remedy

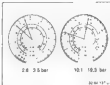
1. Check whether evaporator has ice, then check evaporator sensor.
2. Suck out and measure refrigerant. If sucked out volume is approximately the same as specified charge volume*, check type of expansion valve, then discharge and recharge system.



Low inlet pressure and high outlet pressure indicate a restricted high pressure side.

Remedy

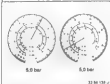
Check condenser, drier and expansion valve.



High inlet pressure and normal outlet pressure indicate a defective compressor.

Remedy

Replace compressor.



Compressor does not run with equal inlet and outlet pressures.

Remedy

If icing-up protector has indicated the compressor off, check evaporator sensor or check power supply to the hydraulic coupling (refer to Electric/Electronic Test for Group 64). Otherwise check magnetic coupling mechanically (clips).

CHECKING AIR CONDITIONER EFFICIENCY (R 134a)

The following conditions must be fulfilled for this test:

1. Model or BMW Service Tester
2. Thermometer
3. Inside air temperature of about 50° C

Ref. Point 1

Connect Model or BMW Service Tester to car and have the evaporator temperature displayed.

Ref. Point 2

Install temperature sensor approx. 5 cm below the car's roof liner at height of B-pillar and focus the display unit outside.

Ref. Point 3

Set heater to maximum heating. Switch on and set air conditioner to circulated air mode. Set car's blower to speed step 4 or maximum speed. Shut all windows and doors. Start and run engine at approx. 2.000 rpm.

Afterwards heat up the passenger compartment to about 50° C. The compressor must no longer switch off. Now measure the passenger compartment temperature and evaporator temperature and subtract the values from each other. There should be a difference of about 40° C.

If this difference in temperature is not reached, connect the service station. Measure the low pressure and high pressure and compare with troubleshooting by means of a pressure test (refer to page 64-50/18).

64-51 200 - CLEANING EVAPORATOR

It could happen that bacteria settle on the fins of the evaporator. This is caused by the condensation water which collects on the fins after switching the compressor off. There could temporarily be an unpleasant odor in the car when the compressor is switched on again. Consequently the evaporator should be cleaned at regular intervals.

NOTE

It is recommended to drive the car to a washbay and do the cleaning there, as the water will run out through the drain holes in the transmission tunnel.

CAR WITH DRKA

Remove the glovebox - refer to Group 51. Unscrew screws and remove the trim panel. If applicable, disconnect the loudspeaker plugs.

Unscrew screws and fold the air duct down.

Disconnect wires from the control unit and final stage.

NOTE

The heater remains installed and was only removed in this picture for better understanding.

Unscrew screws and pull the final stage out.

Important!

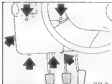
Car with Microfilter

Unscrew screw, pull the microfilter out and reinstall the cover.

Slide Special Tool 64-1 200 into the final stage opening and secure.

Apply about 1 liter of 5 per cent cleaning solution* onto the evaporator by moving the spray nozzle pipe back and forth uniformly.

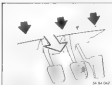
* Refer to Service Information



Clip with trim
Remove plugs
Unscrew screws



Remove trim panel



Unscrew screws
Remove trim panel



Disconnect plug, spread clips apart and lift out resistor



Clip Special Tool 64-1 213 in opening of the resistor



Unscrew and pull out control unit



Unscrew screw (1), turn lever (2) about 90° and remove cover



If applicable, pull out microfilter



12 54 110 0

Close Spectra Tool 64 1 210 into opening and secure.



12 54 110 0

Apply about 1 liter of 5 per cent cleaning solution* on the evaporator by moving the spray nozzle back and forth uniformly.

Leave the cleaning solution on the evaporator for about 10 to 15 minutes.

Afterwards, rinse off the evaporator with a large amount of water (at least 5 liters of water).

64 51 510 Removing and installing evaporator 64 51 520 Removing and installing or replacing expansion valve

Drain refrigerant out of air-conditioning unit with the help of a service unit (refer to 64 50 000 or relevant operating manual for Service Station).

Lift up rubber profile.
Remove plug and overflow hose from expansion tank.

Unscrew nuts on left and right sides of expansion tank and place container to one side.

Note:
Do not bend coolant hose.

Cut wire straps off.
Tie up wiring harness and, if necessary, carefully bend down fuel lines.

Unscrew screws and remove cover plate by lifting upwards.

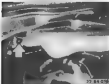
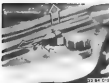
Unscrew nut (1), screws (2) and stud bolt (3).

Inspect hoses.
Replace O-rings.

Caution:
Stud Bolt is secured with Lockite (TV). If necessary, preheat with hot air blower.

Remove glowbox, refer to 51 40 000.
Unscrew screws.
Remove trim by pulling forwards out of rear clip.

Lift out clip and remove cover.





34-51 001-1

Unloosen screws and lift out ventilation duct.



34-51 002-1

Remove all plugs from control unit and lift up wiring harness.

On the automatic air-conditioning system also remove the plug from the output stage.



34-51 003-1

Unloosen screws and remove cover.



34-51 005-1

Unloosen screws and lift out twin tube.

Installation:
Replace O-rings.



34-51 006-1

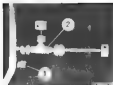
Unloosen screws and lift out separation valve.

Installation:
Replace O-rings.



34-51 007-1

Lift out evaporator.



64-52 REMOVING AND INSTALLING VALVE CORE

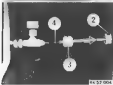
Screw cap (1).
Screw valve core remove (2) on.



Open valve (1).
Unscrew the valve core with valve turner (2).



Pull valve turner (2) back together with the valve core.
Shut valve (1).



Unscrew coupling nut (3) and remove valve turner (2) registered with valve core (4).



Installation:
Refrigerant-proof valve cores can be recognized on the refrigerant seal (1).

7/99 64-52/1

64 52 016 REPLACING AC COMPRESSOR (M20, M30, M35)

Back refrigerant out of the air conditioner with help of a service station (order to 64 52 009 or operating instructions supplied with pertinent service station).

Loosen hose clamp and unscrew nut.
Remove air cleaner.

Important:
Check that air cleaner is in correct installed position.

Cut through wire at top and disconnect plug.

Unscrew suction hose (1) and pressure hose (2).
Insert plugs into open connections without delay.

Installation:
Check O-rings, replacing them if necessary.
Tightening torque*

* Refer to Specifications



Lift the cap and unscrew splash guard.
Loosen screw (1).

Loosen screw (2).
Unscrew adjusting screw (3).
Remove drive belt. Then unscrew screw (1) completely and remove compressor.

Implication:
Remove plugs from connections only briefly before connecting the hoses.
Check for sufficient amount of oil* in the compressor.
Discharge, charge and check the air conditioner for leaks after finishing installation.

Check and, if necessary, correct the drive belt tension using Special Tool 11.8.

Note:
The pulling hook must be applied on the top of a tooth.



* Refer to Specifications

64-52-020 REPLACING AC COMPRESSOR (1992)

Remove engine splash guard
Suck refrigerant out of air conditioner
(refer to 64-52-029 or operating instructions
supplied with pertinent service station).



Unscrew bolts.
Disconnect plug.
Remove compressor downwards.



64-52-020-2



64-52-020-3

Loosen nuts (1) and (5) on tensioning roller
and take ribbed drive belt off of compres-
sor.

Installation

Tighten tensioning roller on hexagon (3) as
far as stops, tighten nut (2) first and then
nut (4).

Tightening torque = 24 Nm.



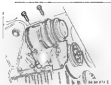
64-52-020-4

Unscrew couplings and remove suction and
pressure pipes.

Installation
Recharge Gases

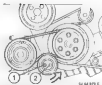
64-52 018 REPLACING AC COMPRESSOR (M70)

Remove engine splash guard.
 Suck refrigerant out of air conditioner.
 (Refer to 64-50 009 or operating instructions
 supplied with pertinent service station).



Unscrew bolts.
 Disconnect plug.
 Remove compressor downwards.

Loosen belt (1) and take drive belt off of
 compressor.



64-52 018 I

Installation
 Loosen bolt (1) enough that tensioning
 roller can turn without friction.
 Insert torque wrench into hexagon socket
 (2) and apply torque against drive belt,
 hold and tighten bolt (1).



64-52 018 I

Unscrew couplings and remove suction and
 pressure pipes.

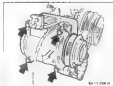


64-52 018 I

* Refer to Specifications

64-52-000 REPLACING A/C COMPRESSOR (R450)

Remove engine splash guard.
 Flush refrigerant out of air conditioner.
 Refer to 64-58-000 or operating instructions
 supplied with pertinent service station.



64-52-000-1

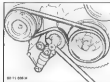
Unhook bolts.
 Disconnect plug.
 Remove compressor downwards.



64-52-000-2

Loosening Drive Belt

Insert hexagon socket key into bolt of fan
 winding motor.
 Turning slowly in clockwise direction will
 compress the remaining element and loosen
 the drive belt.



64-52-000-3

Installation

Check arrangement of ribbed drive belt.
 When installing the ribbed drive belt, com-
 press the remaining element again and
 install belt.
 Check for correct seating in grooves.



64-52-000-4

Unhook couplings and remove suction and
 pressure pipes.



64 31 REPLACING TEMPERATURE SWITCH FOR COMPRESSOR

Loosen the hose clamp and unscrew the nut.
Remove the air cleaner.

Important:
Check that the air cleaner is in correct installed position.



Cut through the wire strip and disconnect the plug.



Remove the temperature switch.

Note:
Shown on removed compressor as it would not be visible because of the pressure hose in installed state.

64-52 041 Replacing compressor coupling (M20, M30, M50 with Vee belt)

Remove splash guard.
Unfasten Vee belt.



30 64 047

Strip drive plate with special tool 64-5 033 and
unfasten screw (1).



30 64 048

Some extractor tool 64-5 013 into the drive
plate. Turn screw (1) in opposite direction to
compressor shaft and remove drive plate.

Caution!

When removing, ensure that shims do not
drop down.

Send up lug on retaining tab, a flange
grooved nut with special tool 64-1 112 and
remove pulley wheel.



30 64 049



30 64 050

Unseize belts. Disconnect cable tie and plug
connection. Remove magnetic coil.

Insulation

Check for correct clearance A (0.5 - 0.8) be-
tween drive plate and pulley wheel (see
B necessary, adjust with shims).

64 52 001 Replacing compressor coupling (for Delta compressor)

Remove compressor refer to 64 52 000.



64 52 001 4

Grasp drive plate with special tool 64 1 020 and unscrew screw (1). Remove drive plate.

Installation:
Check correct clearance A (0.5 - 0.8 mm) between drive plate and pulley wheel. If necessary, adjust with shims.

Expand retaining ring and remove



64 52 001 5

Remove pulley wheel with standard three-claw extractor tool.

Caution!
Apply pulling force only on point between sole-rod bolt and pulley as otherwise pulley could be damaged.



64 52 001 6

Installation:
Drive pulley on to bearing set carefully using special tool 33 1 020.



64 52 001 7

Expand retaining ring and remove.
Unscrew bolt (1).
Disconnect plug connection (2) and remove selected coil.



64 52 001 8



24 54 000 1



24 54 000 2



24 54 000 3



24 54 000 4

64 52 041 Replace compressor coupling on refrigeration compressor

Unscrew and remove splash guard

Loosen nuts (4 and 5) on the retaining roller and remove toothed pulley belt from compressor

Installation:

Turn transporting roller on its head (3) until tight, then tighten nut (4) followed by nut (5).

Tightening torque = 24 Nm



14 54 000 1



24 54 000 1



54 54 000 1

Expand retaining ring

Remove pulley wheel

Expand retaining ring and remove. Unscrew bolt (1). Disconnect plug (2). Remove solenoid coil.

Grip drive plate with special tool 64 5 090. Unscrew central screw and remove drive plate

Check correct clearance A (0.5 - 0.8 mm) between drive plate and pulley wheel. If necessary, adjust with shims

64 53 516 Replacing dryer flask for air conditioner

Removing container for windshield washing unit, refer to Gr. 61 61.
 Drain off refrigerant from air-conditioning unit, refer to 64 50 008 or operating manual for relevant Service Station).

Disconnect or separate plug.

Unfasten nut and disconnect lines.

Installation:
 Tightening torque*
 Check O-rings and replace if necessary

Unfasten screws and remove dryer flask.

* Refer to Technical Data

Remove safety pressure switch and screw onto new dryer flask.

Installation:
 Tightening torque*
 Install with screw cement HWS Mo 64 33 9-007 144.

1 = High pressure switch
 2 = Medium pressure switch
 3 = Low pressure switch

Installation:
 Do not remove sealing plug from connections until shortly before connecting up the lines. Check that oil quantity is sufficient. After successful installation, evacuate air-conditioning unit, charge and check for leaks.

From 2008, only 1 pressure switch with three functions is fitted. (low pressure, high pressure, medium pressure)



84 53 520 Replacing safety high pressure switch (high, medium, low pressure switch)

Remove switch for windblast wash system

refer to Qr. 01 01

Evacuate refrigerant oil from air conditioning unit (refer to 84 50 008 or operating manual for relevant Service Station)



Remove or disconnect plug on safety pressure switch which is to be replaced

- 1 Plug on high pressure switch
- 2 Plug on medium pressure switch
- 3 Plug on low pressure switch



Remove safety pressure switch

Immediately seal all open connections with blind plugs

- 1 Plug on high pressure switch
- 2 Plug on medium pressure switch
- 3 Plug on low pressure switch

Installation:

Tightening torque*

Fit switch with screw securing device R908 No. 01 22 0 407 144.

Reconnect plug connection (1) and unscrew switch.



On version with a multi-function pressure switch (high, medium and low pressure), disconnect plug connection (1) and unscrew switch.

64 53 550 Removing and installing or replacing condenser for air conditioning unit

Remove bumper and BSW hiding grille.
 Drain refrigerant off from air conditioning unit (refer to 64 50 000 or operating manual for relevant Service Station).

Unfasten nuts, disconnect plug connection

Unscrew bolts

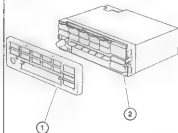
Lift up condenser and remove by pulling down



65 Radio and special equipment

65 11 030	Radio (Business) – remove and install or replace	65-	11/1
030	Radio (Bavaria C II or C Reverse II)	65-	11/2
030	Radio "Bavaria Electronic" – remove and install or replace	65-	11/3
030	Radio "Becker Mexiko Electronic" – remove and install or replace	65-	11/4
030	Radio "Bavaria Mono Digital" – remove and install or replace	65-	11/5
65 12 000	Front loudspeakers – remove and install or replace (footwell, left)	65-	12/1
000	Front loudspeakers – remove and install or replace (footwell, right)	65-	12/1
020	Rear loudspeakers – remove and install or replace (left or right)	65-	12/2
65 13 050	Loudspeakers – remove and install or replace (in instrument panel)	65-	13/1
070	Loudspeakers – left or right – remove and install or replace (in mirror triangle)	65-	13/1
	Fault diagnosis for Bavaria radio C Professional	65-	99/1
	Connecting wires – check	65-	99/1
	Pin assignments	65-	99/2
	Overview of defect codes	65-	99/3
	Defect code 01	65-	99/4
	Defect code 02	65-	99/5
	Defect code 03	65-	99/6
	Defect code 04	65-	99/7
	Defect code 05	65-	99/8
	Defect code 06	65-	99/8
	Defect code 07	65-	99/9
	Defect code 08	65-	99/9
	Defect code 09	65-	99/10
	Defect code 10	65-	99/11
	Test mode for BMW car radio (Bavaria C III)	65-	99/12
	Test mode for BMW car radio (Bavaria C Reverse II)	65-	99/13
	Test mode for BMW car radio (Bavaria C Reverse RDS)	65-	99/14
	Test mode for BMW car radio (Bavaria C PROFESSIONAL)	65-	99/15
	Test mode for BMW car radio (Bavaria C PROFESSIONAL RDS)	65-	99/17
	- set for use of adapter leads between radio and vehicle wiring harness	65-	99/19
	Bavaria radios – troubleshoot	65-	99/20
84 11 510	Eject box – remove and install		refer to HQ-84

65-11-920 REMOVE AND INSTALLING OR REPLACING RADIO (Business)



J - 65-999

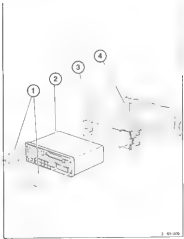
- 1. Dash
- 2. Radio



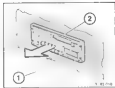
Put off Mask (1).
Unscrew screws (2) on left and right sides.
Put radio (2) out of radio opening.



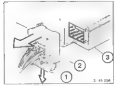
Put out lock (1) and disconnect plug (2)
on radio (3).



- 1. Unlocking hooks
- 2. Radio
- 3. Radio console
- 4. Radio opening

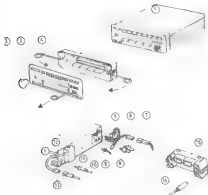


Press unlocking hooks (1) into radio on left and right sides.
Pull out radio carefully with hooks



Pull out lock (1) and disconnect plug (2) on radio (3)

1.3 Radio: "Beavis Electronics"



- 1 Radio
- 2 Main
- 3 Face
- 4 Unlocking hooks for radio removal
- 5 Plug for B+ and ground
- 6 Adaptor
- 7 Plug for power supply to electronics and lights

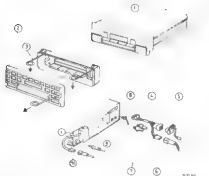
- 8 Plug for speakers
- 9 Plug for automatic antenna
- 10 Plug for antenna
- 11 Adaptor for non-dependent loudness regulation
- 12 Switch for 11
- 13 Plug for 11
- 14 Plug for 11
- 15 Plug receptacle on instrument cluster



Pull off knob
Take off main carefully with the unlocking
hook
Note:
Only attach hook on main

Push back clamps on left and right sides with
unlocking hooks and pull out radio

1.4 Radio Becker Mexico Electronic



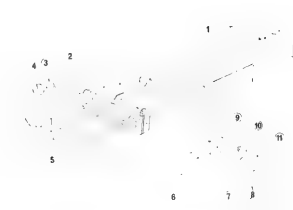
- 1 Radio
- 2 Control panel
- 3 Unlocking hook for radio removal
- 4 Adapter
- 5 Plug for B+ and ground

- 6 Plug for power supply to electronics and lights
- 7 Plug for speaker
- 8 Plug for automatic antenna
- 9 Plug for antenna
- 10 Connection for speed dependent loudness regulation



Take off control panel with unlocking hooks (1)
 Note
 Control panel fits very tight

Push back clamps on left and right sides with unlocking hooks and pull out radio



10-65-385

- 1 Radio
- 2 Unloading hook for removal
- 3 Sound control
- 4 Knob
- 5 Mask
- 6 Antenna plug

- 7 Power connection for automatic antenna
- 8 Speaker plug
- 9 Plug for B+ and ground
- 10 Adapter
- 11 Plug for power supply (form. 304)



24 91 000 F

**65-13 000 REMOVING AND INSTALLING
OR REPLACING FRONT LOUD-
SPEAKER (Footwell - Left)**

Pull off door seal



24 91 000 F

Pry out cap (1), unscrew screw (2) and pull
out screw (3)



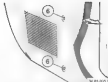
24 91 000 F

Turn retainers (4) about 90° and lift out
side trim panel



24 91 000 F

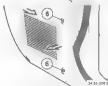
Pull off plug, unscrew nuts (5) and remove
loudspeaker



24 91 000 F

**65-13 000 REMOVING AND INSTALLING
OR REPLACING FRONT LOUD-
SPEAKER (Footwell - Right)**

Pull off door seal and turn retainers (5)
about 90°



24 91 000 F

Lift side trim panel in area of retainers and
pull out towards rear



24 91 000 F

Pull off plug, unscrew nuts (5) and remove
loudspeaker



**65-12-200 REMOVING AND INSTALLING
OR REPLACING REAR LOUD-
SPEAKER (Left or Right)**

Pry out loudspeaker mesh

24-00-001-1

Unscrew screws and lift loudspeaker



24-03-000-1



Pull off plug and remove loudspeaker
completely

24-03-000-1



65 13 000 REMOVING AND INSTALLING
OR REPLACING LOUD-
SPEAKER (in Dashboard)

Pry out cover (1).



Unscrew screws and lift loudspeaker



Pull off plug and remove loudspeaker
completely



65 13 000 REMOVING AND INSTALLING
OR REPLACING LOUD-
SPEAKER (in Mirror Triangle)

Unscrew screws.
Unclip loudspeaker in top and tilt forward.



Pull off plug and remove loudspeaker

TROUBLESHOOTING SAHARA C PROFESSIONAL RADIO

Sahara C is available in two versions, with or without CD player. Controls and receiver are separated from each other for both versions. Controls are located in the dashboard as always, while the receiver and when applicable CD player are in the trunk. Because of this a connecting wire is required from the controls to the receiver and CD player, which later in the course of troubleshooting will be referred to as **V1** (without CD player) or **V2** (with CD player). Wires **V1** and **V2** only differ in length, because connecting wire **V1** leads from the controls to the CD player first and then these together with **V2** to the receiver.

Checking Connecting Wires

Connecting wires must be checked for continuity and short circuit. Procedures:

Unplug connecting wire on both ends

Connect a short circuit bridge „Special Tool“

1 pin 12-pin line plug of **V1** or **V2**

Measure at the other end with a multimeter and test points, whether there is a continuity

Between the various pins

Remove short circuit bridge

There should no longer be continuity between pins

Proceed according to with the **V2** wire. Only a different short circuit bridge „Special Tool“ is required



Connections for Cassette End:

- 1 Plug, 12-pin (power supply)
- 2 Plug, 10-pin (to receiver with connecting wire **V1** or to CD player with connecting wire **V2**)
- 3 Fuse x 3 amperes



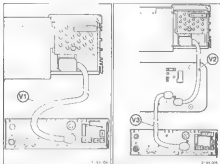
Connections for Receiver End:

- 1 Ant. dir.
- 2 Remote control
- 3 Fuse x 3 amperes
- 4 Plug, 4-pin (power supply)
- 5 Plug, 1-pin (electronic antenna)
- 6 Loudspeaker front left
- 7 Loudspeaker front right
- 8 Loudspeaker rear left
- 9 Loudspeaker rear right
- 10 Plug, 8-pin (from controls with connecting wire **V1** or from CD player with connecting wire **V2**)
- 11 Antenna connection



Connections for CD-Player End:

- 1 Plug, 1 pin (12 V control outlet)
- 2 Fuse x 3 amperes
- 3 Plug (power supply)
- 4 Plug (to receiver with connecting wire **V2**)
- 5 Plug (from controls with connecting wire **V2**)



Routing of Wires without CD-Player

Routing of Wires with CD-Player

Pin Connect Sticks**17 Pin Plug (Controls)**

Pin	0	LAC-I bus
Pin	1	3
Pin	4	Telephone mute
Pin	5	Term. 75 (connected pos.)
Pin	6	Not used
Pin	7	GND-I bus
Pin	8	Not used
Pin	9	Term. 50 (permanent pos.)
Pin	10	GAL (Speedometer outlet)
Pin	11 + 12	Not used
Pin	13	Term. (Mg) Light
Pin	14	Not used
Pin	15	Term. 21 (ground)
Pin	16	Autosm. antenna

4-Pin Plug (Receivers)

Pin	1	Term. 21 (ground)
Pin	2	Term. 75 (connected pos.)
Pin	3	Not used
Pin	4	Term. 50 (permanent pos.)

4 Pin Plug (CD Player)

Pin	1	Term. 21 (ground)
Pin	2	Not used
Pin	3	Not used
Pin	4	Term. 50 (permanent pos.)

FAULT SURVEY

The objective of troubleshooting is the systematic determination of sources of fault. Possible fault conditions are listed in this fault survey. Certain procedures are specified for each fault condition, which lead to the source of fault by answering a question with YES or NO.

The connection of all plugs on different components should be checked for tight fit prior to troubleshooting.

Cassette switched on, i.e. radio has no action	_____	Fault 51
Cassette switched on, i.e. only click heard from control unit and sound display remains dark	_____	Fault 52
Cassette switched off	_____	Replace control unit
No sound from one or more loudspeakers with radio, cassette or CD player on (displays are visible)	_____	Fault 53
No sound from one or both channels only with cassette on	_____	Fault 54
Sound quality disturbed with cassette on	_____	Fault 55
Faulty cassette drive such as IN/OUT fast forward or reverse	_____	Fault 56
Radio reception faulty	_____	Fault 57
CD player rejection button for CD magazine does not work	_____	Fault 58
CD player failure	_____	Fault 59
Faulty reaction to loudness or sound quality adjustments	_____	Fault 10
Faulty displays (undefined symbols displayed)	_____	Replace control unit

FAULT 01

Radio cannot be switched on - no reaction

Is there battery voltage on 17 pin plug
in control unit between pins 8 and 10?no - Repair break in positive or ground
wiring.

yes

+

Is fuse in control unit okay?

no - Replace fuse

yes

+

Replace control unit

FAULT 60

Radio does not switch on. Click heard in control unit, but no sound and display is dark.

Is there battery voltage on 4 pin plug
in receiver between pins 1 and 3?

no

Repair break in positive or ground
wire

yes

Is fuse in receiver okay?

no

Replace fuse

yes

Is set without CD player?

no

Connecting wires V2 and V3 okay?

no

Replace connecting wires.

yes

Does fault occur again with new
receiver?

no

Replace receiver

yes

Does fault occur again with new
control unit?

no

Replace control unit.

yes

Replace CD player

yes

Is connecting wire V1 okay?

no

Replace connecting wire.

yes

Does fault occur again with new
receiver?

no

Replace receiver

yes

yes

•

Replace control unit.

IF ABL 1-03**No sound from one or more loudspeakers with radio, cassette player or CD player or (displays shown in display)****Sound control in center position?**

no

- Turn sound control to center position (see operating instructions).

yes

•

Are loudspeaker outlets on receiver busy (control with test loudspeaker)?

no

- Replace receiver

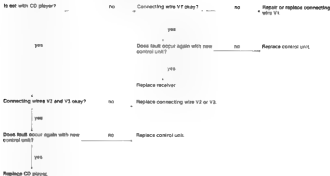
yes

•

Repair loudspeakers or loudspeaker connections.

FAULT IS

Cassette player on - no sound from one or both channels



FAULT 08

Sound quality of cassette player is poor

Is sound control in center position?

no

Adjust sound control (see
• operating instructions).

yes

Does fault also occur with a different
cassette of known good sound quality?

no

• Previously used cassette is faulty
or poorly recorded

yes

Does fault still occur after cleaning
sound head?

no

• Control unit is faulty

yes

Replace control unit

FAULT 09

Cassette play drive malfunctions, e.g. faulty SHOU? (not forward or reverse)

Does fault also occur with other
cassettes?

no

• Cassette has mechanical fault.

yes

Replace control unit.
(Note: Leave selected cassette in
control unit; don't remove with
force.)

FAULT 07**Radio reception faulty**

Does fault also occur with a new receiver?

no → Replace receiver

yes

Check antenna or antenna system and replace faulty part

FAULT 08**CD player ejection button for CD magazine ejection does not react**

Is there battery voltage on 4 pin plug in CD player between pins 1 and 4?

no → Check power supply in vehicle

yes

Is fuse in CD player okay?

no → Replace fuse

yes

Replace CD player

FAULT 06

CD player failure

Installed position of CD player
adjusted correctly and transport
locking screen removed?
(adjusting instructions are pro-
vided on left and right sides of
housing)

no

Adjust installed position correctly
* and remove transport locking screen

yes

-

Replace CD player

FAULT 10

Faulty reaction to loudness and sound control adjustment

Does fault still occur with a new Replace receiver

yes

no

Replace control unit.



34-05-01-0



34-05-01-0



34-05-01-0



34-05-01-0

TEST MODE FOR BMW CAR RADIO (DAIWA C 8)

"DAIWA C 8" radios contain a test mode, with which various types of internal information can be displayed and various operating conditions set.

Starting Test Mode

Press keys "2" and "3" simultaneously while switching the radio on. A capital "B" appears in the display next to the wave range. The selected station is still received.

This service mode is abandoned by switching the radio on and off once.

Changing Loudness Boost for Traffic Reports

Press key "VF" for about 4 seconds until a "B" appears in the display. The station will be a 50% louder. The loudness boost can be adjusted in 5 steps by using the automatic tuning rocker.

The factory setting is "0".

The regulation range is: 0 to 50 dB.

This mode is abandoned by pressing the "VF" key again. The test mode remains activated.

Adjusting Road Speed Dependent Loudness

Press station key "3" for about 4 seconds until "2" appears in the display. This value can be changed by using the automatic tuning rocker.

The factory setting is "0".

Regulation range: "1" weak increase
"2" medium increase
"3" strong increase

This mode is abandoned by pressing the "3" key again. The test mode remains activated.

Switching from "Distance" to "Local" in Satin Mode

Press rocker "a/m" for about 4 seconds until "B" or "L" appears in the display. This setting can be changed by using the automatic tuning rocker.

The factory setting is "B".

Regulation range: "B" distance
"L" local

This mode is abandoned by pressing the "a/m" key again. The test mode remains activated.



SA 65 000 F

TEST MODE FOR BMW CAR RADIO (BAYAREA C REVERSE II)

"BAYAREA C REVERSE II" radios contain a test mode, with which various types of internal information can be displayed and various operating conditions set.

Starting Test Mode

Press keys "3" and "6" simultaneously while switching the radio on. A capital "B" appears in the display.

This service mode is abandoned by switching the radio on and off once.



SA 65 000 F

Changing Loudness Boost for Traffic Reports

Press key "VF" for about 4 seconds until a "0" appears in the display. The station will be a traffic leader. The loudness boost can be adjusted in 3 steps by using the automatic tuning rocker.

The factory setting is "0".

The regulation range is ± 8.25 dB.

This mode is abandoned by pressing the "VF" key again. The test mode remains activated.



SA 65 001 E

Adjusting Road Speed Dependent Loudness

Press station key "3" for about 4 seconds until "3" appears in the display. This value can be changed by using the automatic tuning rocker.

The factory setting is "3".

Regulation range:

- "1" weak increase
- "2" medium increase
- "3" strong increase

This mode is abandoned by pressing the "3" key again. The last mode remains activated.



SA 65 000 F

Switching from "Distance" to "Local" in Latin Mode

Press rocker "M" for about 4 seconds until "H" or "L" appears in the display. This setting can be changed by using the automatic tuning rocker.

The factory setting is "H".

Regulation range:

- "H" distance
- "L" local

This mode is abandoned by pressing the "m" key again. The test mode remains activated.



34-44 233-8

TEST MODE FOR BSW CAR RADIO (BAYAMA C REVERSE RDS)

BAYAMA C REVERSE RDS radios contain a test mode, with which various types of internal information can be displayed and various operating conditions set.

Starting Test Mode

Press keys "3" and "5" simultaneously while switching the radio on. A capital "B" appears in the display.

This service mode is abandoned by switching the radio on and off once.



34-44 234-8

Changing Loudness Boost for Traffic Reports

Press key "TP" for about 4 seconds until a "0" appears in the display. The station will be a traffic station. The loudness boost can be adjusted in 3 steps by using the automatic tuning rocker.
The factory setting is "0".
The regulation range is ± 3 dB.

This mode is abandoned by pressing the "TP" key again. The test mode remains activated.



34-44 235-8

Adjusting Road Speed Dependent Loudness

Press station key "2" for about 4 seconds until "2" appears in the display. This value can be changed by using the automatic tuning rocker.
The factory setting is "2".
Regulation range:
 -1 = equal increase
 0 = medium increase
 +1 = strong increase

This mode is abandoned by pressing the "2" key again. The test mode remains activated.



34-44 236-8

Switching from "Distance" to "Local" in Station Mode

Press rocker "a/m" for about 4 seconds until "H" or "L" appears in the display. This setting can be changed by using the automatic tuning rocker.
The factory setting is "H".
Regulation range:
 "H" = distance
 "L" = local

This mode is abandoned by pressing the "a/m" key again. The test mode remains activated.

Adjusting Viewing Angle for Display

The angle of view can be changed by pressing the "RDS" key (6-31).
Factory setting: dark display with direct view.



34 65-099/15



35 65-099/15

TEST MODE FOR BMW CAR RADIO (BMWARA C PROFESSIONAL)

"BMWARA C PROFESSIONAL" radios contain a test mode, with which various types of internal information can be displayed and various operating conditions set.

Starting Test Mode

Press key "1" and then simultaneously operate keys "B" and "G" within the first eight seconds after the radio has been switched on. The basic menu is displayed.

The entire test is menu controlled.

Basic Menu

The available test functions can be interrogated via the basic menu.

Various codes for the different functions appear in the C-Display for this purpose and these functions can be activated by operating the pertinent key located below the multi-function keyboard.

The different codes set via the following functions:

SYN	Synthesizer set to a fixed frequency
ADW	Adjust values of A/D analog/digital converter displayed
HF	Volume, bass, treble and fader values (on sound control mode) is displayed in dB
LCD	LCD test
TAB	Stored frequency tables displayed
GAL	One of three road speed dependent business tables activated
SM	Serial numbers and software status displayed

In addition, the software status of the front software (week and year) appears in the B-Display.

The test is stopped by pressing the key below "END".



(a) (b) (c)

LCD Test (LCD):
Four different test patterns are switched on in series for all right mounting dials (LEDs) during the LCD test.

- All LEDs switched on
- Chessboard pattern
- Chessboard pattern inverted for second test
- All LEDs switched off

The test can be stopped at any time by pressing key "F", but also returns to the main menu after display of all four test patterns.

Road Speed Dependent Loudness Control (QAL)

With help of this test one of the three road speed dependent loudness tables is activated, through which one each road speed dependent loudness curve can be determined and assigned to the radio.

The instantaneously activated table can be read in the R-display.

The table number is stored in EXPNCA.

Return to the main menu is accomplished by pressing the key below "END".



65-99/17-1



65-99/17-2

TEST MODE FOR BMW CANT RACING (BMW C PROFESSIONAL RS2)

"BMW C PROFESSIONAL RS2" models contain a test mode - with which various types of internal information can be displayed and various operating conditions set.

Starting Test Mode

Press key "1" and then simultaneously opens keys "T" and "O" within the first eight seconds after the radio has been switched on. The basic menu is displayed.

The entire test is menu controlled.

The available test functions can be interrogated via the basic menu. Various codes for the different functions appear in the B-display for this purpose and these functions can be activated by operating the pertinent key located below the multi-function keyboard.

The different codes activate the following functions:

SPK	Synthesizer set to a fixed frequency
ADW	Input values of 8 analog digital converter displayed
RF	Volume, bass, treble and noise values on sound control module displayed in dB
LCD	LCD test
SRL	One of three road speed dependent functions tested activated
SN	Serial number and software status displayed
RAI	Application range (USA, EUR) set

In addition, the software status of the front software (week and year) appears in the B-display.

The test is stopped by pressing the key below "END".

LED Test (LEDs)

Four different test patterns are switched on in series for all light emitting diodes (LEDs) during the LED test.

- All LEDs switched on
Chassisboard power
- Chassisboard power Inverted for second test
All LEDs switched on

The test can be stopped at any time by pressing key "0", but also returns to the main menu after display of all four test patterns.



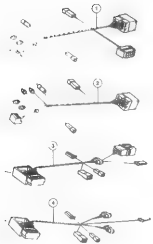
34-44-000-0

Road Speed Dependent Loudness Control (GAL)

With help of this key one of the three road speed dependent loudness tables is activated through which one each road speed dependent loudness offset can be determined and reported to the radio.

The simultaneously recorded table can be read in the B-display. The table number is stored in 00PWH00.

Return to the main menu is accomplished by pressing the key below "END"



LIST OF ADAPTER LEADS FOR USE BETWEEN RADIO AND VEHICLE WIRE HARNESS

Part Number	Fig. no.	Plug on Vehicle Wire	Connection on Radio
65 12 8 330 807	1	17-pin plug and HiFi sound system with four channel radio	Separate plugs for power supply, G.A.L., antenna and four loudspeaker jacks
65 12 8 330 180	1	17-pin plug, HiFi sound system and phase rotation on amplifier with four channel radio	Separate plugs for power supply, G.A.L., antenna and four loudspeaker jacks
65 12 8 330 189	1	17-pin plug and stereo system with four channel radio	Separate plugs for power supply, G.A.L., antenna and four loudspeaker jacks
65 12 8 360 160	2	17-pin plug and stereo system with two channel radio and fade control	Separate plugs for power supply, G.A.L., antenna and four loudspeaker jacks
65 12 8 360 191	2	17-pin plug and HiFi sound system with two channel radio and fade control	Separate plugs for power supply, G.A.L., antenna and four loudspeaker jacks
65 12 8 360 193	3	Separate plugs for power supply, G.A.L., antenna and two loudspeaker plugs and fade control	17-pin connection on radio
62 11 9 410 508	4	Separate plugs for power supply, G.A.L., antenna and four loudspeaker plugs and fade control	17-pin connection on radio

TROUBLESHOOTING BAVARIA RADIOS

	Cause	Correction
<p>Scale light on, but no sound or noise in loudspeakers with loudness set at maximum</p> <p>Automatic tuning working perfectly</p>	<p>Loudspeaker plug on radio loose</p> <p>Break in loudspeaker wiring</p> <p>Plugs on radio control loose</p> <p>Loudspeakers defective</p> <p>Radio defective</p>	<p>Tighten plug</p> <p>Replace wiring</p> <p>Tighten plugs</p> <p>Replace loudspeakers</p> <p>Replace radio</p>
<p>Noise with loudness set at maximum, but no reception</p>	<p>Antenna plug not connected to radio</p> <p>Break in antenna wiring</p> <p>Antenna</p> <p>Radio defective</p>	<p>Connect plug</p> <p>Replace wiring</p> <p>Refer to "checking antenna"</p> <p>Replace radio</p>
<p>Lowest noise while driving</p>	<p>Antenna wiring and plug</p> <p>Antenna</p> <p>Local reception range was abandoned</p> <p>Station key or station tuned in incorrectly</p> <p>Station too weak</p> <p>Radio set to sound-off for traffic reports</p>	<p>Check, replace or tighten if necessary</p> <p>Refer to "checking antenna"</p> <p>Tune in new station</p> <p>Tune in station</p> <p>Tune in stronger station</p> <p>Unset sound-off and tune in station correctly</p>
<p>Unsatisfactory sound quality</p>	<p>Foreign particles in loudspeaker diaphragm or loudspeaker</p> <p>Loudspeaker installed with tension</p> <p>All loudspeakers are not connected identically when using more than one loudspeaker per speaker</p> <p>Fade control set in middle position</p> <p>Only when cassette player is used</p>	<p>Remove foreign particles or replace loudspeaker</p> <p>Loosen and screw on loudspeaker without tension</p> <p>Check for identical poles</p> <p>Adjust fade control to middle position</p> <p>Clean the cassette drive using the cleaning cassette</p>
<p>Cassette ejected while playing</p>	<p>Cassette without S-M mechanism</p> <p>Cassette tape unwinds too hard</p> <p>Cassette housing distorted</p> <p>C 90 or C 100 cassette used</p>	<p>Run cassette forward and backward completely once times</p> <p>These cassettes have very thin tape and tend very quickly to unwind too hard, consequently only use C 60 cassettes.</p>

TROUBLESHOOTING BAVARIA RADIOS

Condition	Cause	Correction
Creaking and buzzing noise	Engine or ignition interference	<p>Turn in a weak station.</p> <p>Run engine at approx. 3,000 rpm, switch ignition off. If interference noise stops by switching off the ignition, it concerns ignition interference.</p> <p>CRD-Circuit</p> <p>Distributor cap shielding</p> <p>Ground strap for shielding connected</p> <p>Shielded capacitor 2.2 μF to ignition coil terminal (n.b.)</p> <p>Regulator coil for distributor ignition</p> <p>Shielded filter in lead to</p> <p>ignition leads, plug connections, distributor cap, ignition coil for perfect connection and resistance*</p> <p>Distributor rotor resistance*</p> <p>Heating cracks in distributor cap, distributor rotor, ignition coil neck, spark plugs, plug connectors</p> <p>Ground strap from engine to body</p> <p>Ground strap from engine fixed to body</p> <p>Ground connection of radio</p> <p>Engine hood closed correctly</p>
Creaking and clicking noise	Defective alternator regulator	<p>Race engine enough until interference noise can be clearly heard. Now switch on headlights and rear window defogger. The regulator is defective if the interference noise stops or changes.</p>
Howling or whistling noise, depending on engine speed	Interference from alternator	<p>Remove drive belts and run engine briefly. If this produces interference, replace or service. Install capacitor on terminal (+) of alternator.</p>
Stuttering and clicking noise only while driving, but stops after operating brake pedal	Electrostatic charge	<p>Inspect wheel hub contacts on lower axle</p>
Howling and creaking noise when equipment is switched on	Windshield wiper motor, additional water pump,	<p>Install 2 x 0.47 μF shielded filters</p>
Beep light not on or no display and no reception	Fuse blown Power supply wire loose or not connected Radio defective	<p>Replace fuse</p> <p>Connect wire</p> <p>Replace radio</p>
* Refer to Specifications		

66 Transmit and receive equipment

66 10 000	Infrared locking system – check function	66-	10r1
010	Receiver (infrared locking system) – remove and install or replace	66-	10r1
020	Logic unit (infrared locking system) – remove and install or replace	66-	10r2
030	Display unit (infrared locking system) – remove and install or replace	66-	10r2
	Infrared transmitter – initialize	66-	10r3
	Compact infrared transmitter – initialize	66-	10r3
66 20 010	Control unit (park distance control) – remove and install or replace	66-	20r1
050	Rear ultrasonic converters all – remove and install or replace	66-	20r2
060	Rear speakers (park distance control) – remove and install or replace	66-	20r4

66-10-000 Check function of infrared locking system

Refer to Decoral Troubleshooting Manual for function description and troubleshooting instructions.
S Series

Caution

From September 1992, the compact infrared locking system will be installed.
Recognition feature: Receiver and control unit are installed in rear view mirror.

Refer to Electrical Troubleshooting Manual for function description and troubleshooting instructions.
S Series



66-10-010 Removing, installing or replacing the receiver (infrared locking system)

Location

Without sliding/tilting sunroof
In front passenger
Compress retainers and lift out receiver
Disconnect plug.



With sliding/tilting sunroof
In the door for the sliding/tilting sunroof drive unit.

Unclip roof section
Press together the retaining books in the receiver.
Lift out receiver
Disconnect plug.



Caution

From September 1992, the compact infrared locking system will be installed.
Recognition feature: Receiver and control unit are installed in the inside rear view mirror.

66 10 020 Removing, installing or replacing logic section (infrared locking system)

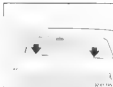
Location: In power distributor at back
Remove: rear seat, refer to 10 20 000



(2) Control unit (rear section) of the infrared locking system

Caution!
 From September 1992 the compact infrared locking system will be installed.
 Recognition feature: Receiver and control unit are installed in the inside rear view mirror.

Installation:
 Whenever the logic section is removed or exchanged (control unit), all the infrared transmitters (max. 4 units fixed) must be re-installed.



66 10 030 Removing, installing or replacing the display unit (infrared locking system)

Unit: in rear, on ventilation grid.

Uncover bolts.
Disconnect plug.



66 10 . . Initializing the infrared transmitter

Initialization of the transmitter is required if the transmitter was without electric power for more than one minute when commissioning a new transmitter

It is not necessary to initialize a transmitter when (changing a transmitter battery in less than one minute (batter stores with integral condensat)

66 10 . . Initializing compact infrared transmitter

Caution!
From September 1993, the compact infrared locking system will be installed.
Recognition feature: Transmitter and control unit are installed in the inside rear view mirror

Initializing a transmitter refer to vehicle-specific Device s Manual

Initialization

1. Switch on ignition with second key in vehicle
2. Place transmitter directly on display section (LED must point in direction of ignition)
3. Press UNLOCK until the LED on the transmitter starts to flash
Transmitter is now initialized

Note
When a transmitter is reinitialized, this cancels all previously initialized units in a system (up to 4 units may be fitted)
This means that all transmitters fitted in a system have to be initialized again
This procedure must be carried out within 15 minutes. During this time, the ignition must not be switched off

65-20-010 Removing and installing or replacing control unit (Park Distance Control)

Installation location

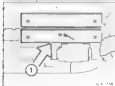
In power distributor beneath back seat.

Removing back seat, see Group 52.

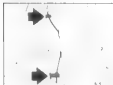


Remove screen

Remove cover



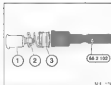
Remove control unit (1).



66-20-050 Removing and installing or replacing all ultrasonic converters

Removing rear bumper, see Group 11
Pull bumper slightly forwards
Unclip leads from a type on bumper

Disconnect plug connections on ultrasonic converter



Removing ultrasonic converters (2) and (3) in center of car



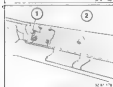
Pull slide (1) down as far as stop with special tool 66-2-101



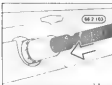
Ultrasonic converter on left side of car



Ultrasonic converter on right side of car



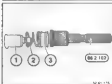
Installation instruction:
Locate ultrasonic converter in the grooves in the bumper (locking device).



Ultrasonic converters (1) and (4) on the butt side of the bumper.
Press special tool 66-2-102 firmly home. Locking ring is unlocked.



Installation instruction
Ultrasonic converter must locate in the groove on the bumper.

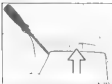


Installed state
(Illustrated here in dismantled condition).
Install ultrasonic converter in bumper, fit spring (2), locking ring (2) and slide home with special tool 66-2-102.
Locking ring (2) must suitably locate and ultrasonic converter must be mounted firmly on the bumper.



66 20 060 Removing and installing or replacing rear loudspeakers (park distance control)

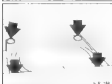
Unclip rear loudspeaker panel



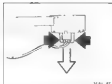
Detach of loudspeaker panel



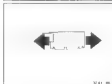
Unscrew screws in the loudspeaker panel



Remove loudspeaker
(1) Loudspeaker for Park Distance Control

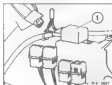


Disconnect plug



Unclip loudspeaker

Routing:
Rear/rear right side wheel arch area in trunk,
see 51 47 180

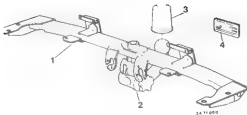


Loudspeaker is mounted beside wiper relay
(1).
Remove screw
Disconnect plug

71 Engine / chassis equipment / accessories

71-60	Overview of trailer hitch with detachable ball hitch	71-60/1
	Trailer module - remove and install	71-60/2
	Connector assignments of 13-pin plug connector	71-60/3

TRAILER HITCH WITH REMOVABLE BALL HEAD



- 1 Trailer hitch (main body)
- 2 Ball head
- 3 Cover
- 4 Data plate



- 1 Key
- 2 Handle (for removable ball head)
(pull out, turn and remove ball head)
- 3 Ball head
- 4 Socket



71-60 REMOVING AND INSTALLING TRAILER MODULE

Lift off trim panel partially.

Unscrew screws (1 and 2).
Pull off plugs (3 and 4).
Lift out trailer module.

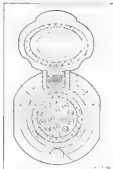
Spare fuses

Note

Also refer to fuses 18 and 22 in the fusebox should the system fail.



go to 60/3



Pin 66 CONNECTIONS OF 13 Pin PLUG

Pin 1	Turn signal indicator, left
Pin 2	Tail fog lights
Pin 3 *	Ground (for circuit of contacts 1 through 8)
Pin 4	Turn signal indicator, right
Pin 5	Right tail light, identity light, marker light and license plate light
Pin 6	Brake lights
Pin 7	Left tail light, identity light, marker light and license plate light
Pin 8	Backup light and/or backup device for overrun brake
Pin 9	Power supply (permanent positive)
Pin 10	Positive charge wire for battery
Pin 11	Not used
Pin 12	Not used
Pin 13 *	Ground (for circuit of contacts 9 through 12)

* Ground wires may not be connected electrically conductive on the order end.

72 Body equipment and accessories

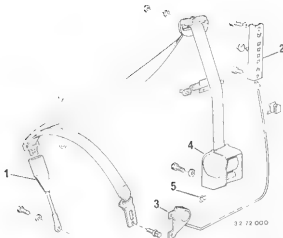
	Layout of seat belt	72-	11/1
72 11 030	Front seat belt – remove and install or replace	72-	11/2
102	Seat belts (complete), all – remove and install or replace	72-	11/4
	Buckle pretensioner	72-	11/5
	Buckle pretensioner – disarm	72-	11/6
	Automatic reel seat belt – check	72-	11/7
	Check list for automatic reel seat belt	72-	90/1

Seat Belt Arrangement

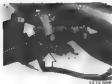
- 1 Lower strap
- 2 Belt height control
- 3 Cable roller
- 4 Automatic reel
- 5 Installation on seat

The belt height control is connected directly to the front seat with a cable.

Consequently the position of the upper strap in relation to ryal height depends on the seat's forward/back position



Seat forward = lower position
Seat back = upper position



32 72 004

72 11 030 REMOVING AND INSTALLING OR REPLACING FRONT SEAT BELT

Important

Models with Seat Belt Tensioner
Conform with safety precautions!
Improper handling could cause triggering of the belt tensioner and lead to injury.
Disconnect battery and discharge all cable pole or terminal.

Run seat forward and to highest position.
Unscrew bolts on left and right sides.
Disconnect cable.

Installation

Tightening torque*



32 72 000



32 72 000



12 72 004



32 72 000

Put on rubber door seal partially and fit out trim panel.

Installation

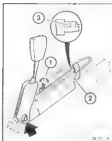
Lift out plug partially.

Unscrew screw.
Lift out guide (1).

Installation
Tightening torque*

Unscrew screw.
Lift out holder.

Installation
Tightening torque*



32 72 000

With Seat Belt Lock Tensioner
Remove seal (refer to Group 52)

Important

Disconnect seat belt lock tensioner
Tensile cable (1) out of holder and disconnect on seat.
Power seat: glow in scope (2), display (3) changes from "green" to "red".

Remove seal belt lock tensioner

Installation

Tightening torque*
Cable must be secured with a cable strap above the attachment point through the opening in the holder.

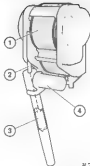
* Refer to Specifications



Unfasten screw.
Remove seat belt height adjuster together with cable.

Installation:
"lightning" torque!

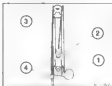
Note:
If necessary, the complete seat belt height adjuster must be replaced, including the retractor.



Seat Belt Retractor

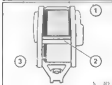
- 1 Reel
- 2 Piston in cylinder
- 3 Piston in cylinder
- 4 Gas generator

Refer to Group 23 for description of operation.



Seat Belt Height Adjuster

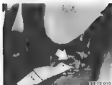
- 1 Spring
- 2 Upper (left) anchorage point
- 3 Retracting roller
- 4 Cable



Seat Belt Reel

- 1 Reel
- 2 Clamp
- 3 Piston roller

* Refer to Specifications



72-11-103 REMOVING AND INSTALLING OR REPLACING A1, REAR SEAT BELTS (Complete)

Remove rear seat cushion and backrest (refer to Group 18).

Unscrew bolt.

Installation
Tightening torque*

Unscrew bolt.

Installation
Check for correct seating at belt anchorage
Tightening torque*



Remove clips.

* Refer to Specifications



Unscrew bolt.

Tightening torque*

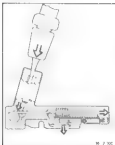
Removing seat belt reel in "routing" models
- refer to Removing Cargo Room Trim Panels in Group 81.
Load-through installation - refer to Gr. 81



Unscrew bolt.

Installation
Tightening torque*

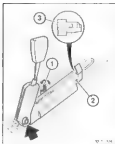
* Refer to Specifications



SEAT BELT LOCK TENSIONER

Description

A mechanical impact sensor activates the system in case of a head-on collision.
A pre-tensioned spring pulls back the belt lock approx. 85 mm.
Shoulder and waist belts are tensioned.



Manual Seals

To avoid unwanted activation while adjusting seat (sudden movement against the final stop) or working on seat the system is activated and deactivated with help of cable (1).

Power Seals

The system is deactivated by screwing in screw (2) for working on the seat.

Check color of display (3).

- Red • deactivated
- Green • activated

Caution

The system is activated when the cable is connected on seat or green display is visible.

An activated seat belt lock tensioner must always be replaced!



25 15 DEACTIVATING SEAT BELT LOCK TENSIONER

Caution

Comply with country's accident prevention regulations.

The seat belt lock tensioner is "activated" when deployed (A) to a 10 mm.



Clamp seat belt lock tensioner in a vise at the point where it is bolted to the seat. Belt cable must be horizontal. Pull locking cable out as far as snap and keep it tight with a pliers.



Seat Belt Lock Tensioner for Power Seats

Turn screw (1) until green mark (2) appears in the window - seat belt lock tensioner is activated.



Caution

Keep hands away from the belt lock tensioner while deactivating - danger of injury!

Apply a firm knock from the (B) of a hammer weighing 500 grams to the belt lock tensioner in cone (A).

This will loosen the belt lock tensioner.



Belt lock must face away from the body of the mechanic.

Caution

Persons, who have to be on the belt lock side, must stand at least 3 meters away in the interest of safety.



Deactivating will cause the belt lock to be pulled back into the housing suddenly by a distance (B) of approx. 55 mm.

72-11 INSPECTING AUTOMATIC REEL SEAT BELTS

The automatic reel has two independent activating systems for the locking of seat belts.

The first activating system should lock the automatic reel when driving fast in curves, driving in tight curves, when car rolls over during sharp braking or by impact.

This activation is accomplished with a ball.

To check seat lockers must be set upright and both hands held in supporting position close to the steering wheel. Afterward the brakes must be applied fully while driving on a dry surface and at a road speed equal to twice walking speed.

The seat belt should lock.

The second activating system is for additional safety and controlled by inertia mass.

This system is also okay if the reel locks when putting out the belt suddenly.

The automatic reel does not require servicing and must not be opened.

The belt should retract on its own as far as possible when released in parked position.

If the reel action is not round, the return spring could be weak or broken and there could be excessive friction in belt guides.

A non-usable seat belt or a seat belt, worn in a serious accident, should be destroyed immediately after removal to guarantee that it cannot be used again.

To insert a seat belt the tongue should insert easily and with a loud click in the lock. When pressing the "PRESS" button the belt tongue should be ejected from the lock by spring force.

If the lock cover is missing or damaged, the seat belt must be replaced.

When replacing a seat belt, the lower strap must also be replaced.

The tongue of the lower strap on the seat rail could be deformed by the impact of an accident in the case of seat belts integrated in a seat.

Attempts should never be made to straighten the seat or seat rail.

Belt straps should only be washed with a lukewarm soap solution or a commercial line laundry detergent.

Belt straps must never be cleaned chemically or dyed.

Automatic reel seat belts must be replaced in case of

- activated belt sensor not
- functioning
- unwinding,
- pinches,
- tears and cuts,
- traces of melting,
- traces of abrasion in plastic cover on belt opening for tongue or
- damaged seams on end of belt strap.

Also refer to Check List for Automatic Reel Seat Belts.

CHECK LIST FOR AUTOMATIC REEL SEAT BELTS

Has automatic reel seat belt and lower strap been replaced after head-on or side collision with more than parking damage?

no

Replace automatic reel seat belt

yes

Does seat belt lock when pulled out suddenly?

no

Replace automatic reel seat belt

yes

Can belt be pulled out without hesitation?

no

Reel is loose - tighten reel.
Return spring is broken - replace seat belt

yes

Does belt retract on its own, whereby last section might have to be guided in?

no

Excessive friction in belt guides - replace seat belt
Reel loose - tighten reel.
Return spring broken - replace seat belt

yes

Does automatic reel cause a squeaking noise when belt is fastened or unfastened?

yes

Excessive friction in belt guides - replace seat belt
Reel loose - tighten reel
Return spring broken - replace seat belt

no

Does plastic cover on tongue in area of belt opening have traces of wear?

yes

Replace complete automatic reel seat belt

no

CHECK LIST FOR AUTOMATIC REEL SEAT BELTS



84 Communications system

84 11 510 Eject box – remove and install or replace

84- 11:1



84 11 510 Removing and installing eject box

1. Lift off telephone receiver.
Press together clip and disconnect plug con-
nection.



2. Unscrew rear finisher screws and lift out by pulling
out forward.



3. Press down clips, slide eject box forward and
lift out by pulling upward, place to one side.



4. Release screws and pull out support bracket.



5. Disconnect plug connections and completely
lift out eject box.

97 Body cavity sealing and undercoating

Body cavity sealing

97- 00/1

97-00/1

BODY CAVITY SEALING - S SERIES E 34

Preparations for Body Sealing

Protect wheels with covers*

Undercoats of car must be clean and dry

If necessary, repair damaged undercoating (including wheel housings and side panels) with PVC and treat with Isolyt

The thickness of the undercoating should not exceed 3.2 mm (0.125")

Inspect car for damaged paint finish or damage from flying stones and, if applicable, repair after receiving permission from the customer

Body sealing compound and car should have room temperature (about 25 °C / 68 °F).

Check spray pattern of guns and hoses

When drilling holes, dip the stepped drill bit in sealing compound to hole the burrs

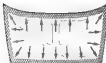
Remove dripping sealing compound

Plug all drilled holes with plugs dipped in Isolyt* after finishing sealing procedures.

Spray engine and engine compartment with engine wax to cover seal

When repairing accident damage or replacing body parts, seal body cavities immediately after paint spraying and prior to installation of engine, axle, transmission, trim panels, etc. If repair welding is only accessible externally, the side, which produces a cavity, must be sealed with wax. This is also applicable to rear side panels, above the wheel house to the roof joint, as well as doors, especially in the upper corner areas

Coat thickness should be at least 0.03 mm (0.001")

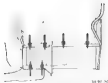
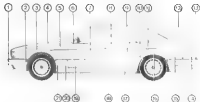


12 94' 000

Let the sealing compound penetrate into gaps and spot welding flanges completely
Gaps and flanges are to be sealed in this manner

Note:
Marked holes are in reference to only one side of the car
Also seal body cavities on the other side accordingly as required

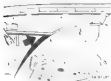
Body cavity sealing performed after body repairs must be confirmed in the annual inspection sheets



1. Front bumper take-up
- spray gun



2. Front engine carrier member
- nylon scribe



3. Support member/front wheel house
- hook-type scribe



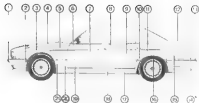
4. Engine hood
- hook-type scribe
- nylon scribe



5. Support member/front wheel house
- nylon scribe



6. Front door
- hook-type scribe



7. Front door
- spray gun



8. Rear door
- hook-type sonde



9. Rear door
- spray gun



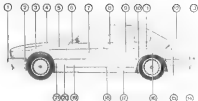
10. Rear wheel house, outside
- hook-type sonde
Turn 360° while spraying.



11. Rear wheel house, inside
- nylon sonde



12. Trunk (6)
- hook-type sonde
- nylon sonde



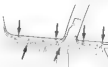
18. Tumb

• nylon sonde



19. Rear wheel house
(accessible from bottom of wheel house)

• nylon sonde



17 Side member

• nylon sonde



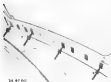
16 Bumper

• nylon sonde



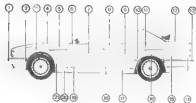
13. Rear bumper take-up

• nylon sonde



14 Tail panel

• nylon sonde



010



21 010-1

21 Front wheel hub

- nylon sensor



19 Engine carrier, inside

- nylon sensor



20 A-pillar, bottom

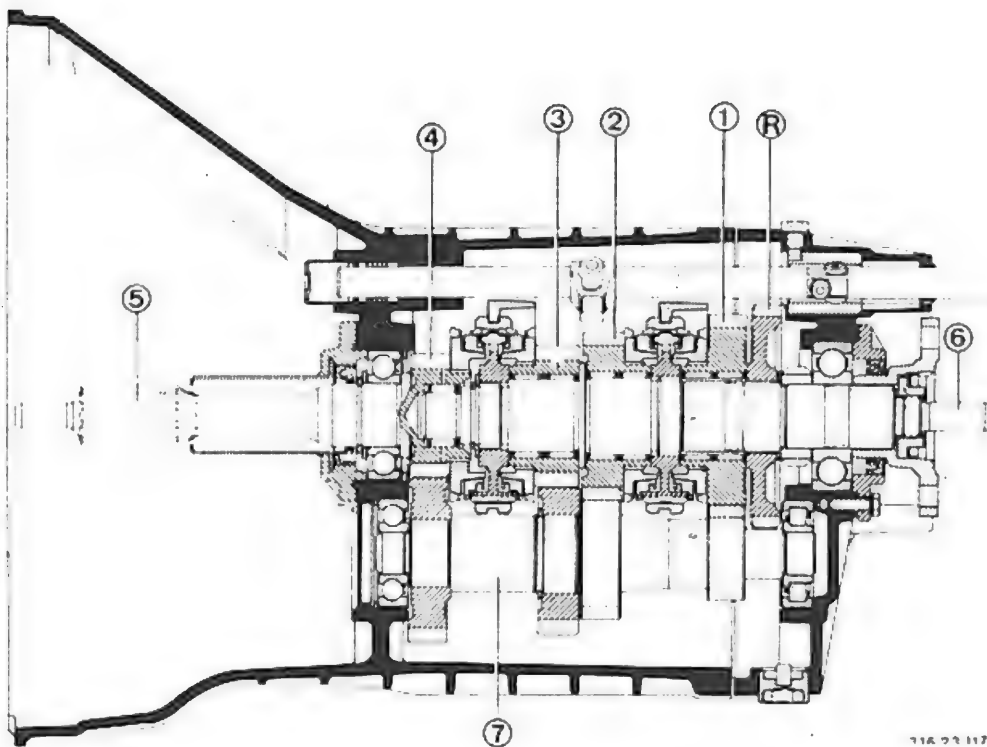
- nylon sensor
- hook-type sensor
- Turn 90° while spraying.

Construction group 23 Manual transmission

Getrag 242/4 Speed transmission

	Transmission – layout drawing	23-	10
	Shift mechanism – layout drawing	23-	11
23 11 000	Transmission case front section – remove and install/seal	23-	12
621	Cover with guide tube for clutch release bearing – seal or replace	23-	13
23 12 501	Radial oil seal for input shaft – replace	23-	14
531	Radial oil seal for output flange – replace	23-	14
561	Radial oil seal for selector shaft – replace	23-	15
23 21 500	Input and output shaft assembly – remove and install	23-	16
551	Output shaft – replace	23-	20
701	Bearings of all transmission shafts – replace	23-	22
23 22 551	3 rd /4 th gear set – replace	23-	24
23 23 503	Synchronization – disassemble and assemble	23-	26
23 31 501	1 st /2 nd and 3 rd /4 th gear selector forks – replace	23-	27

23-10

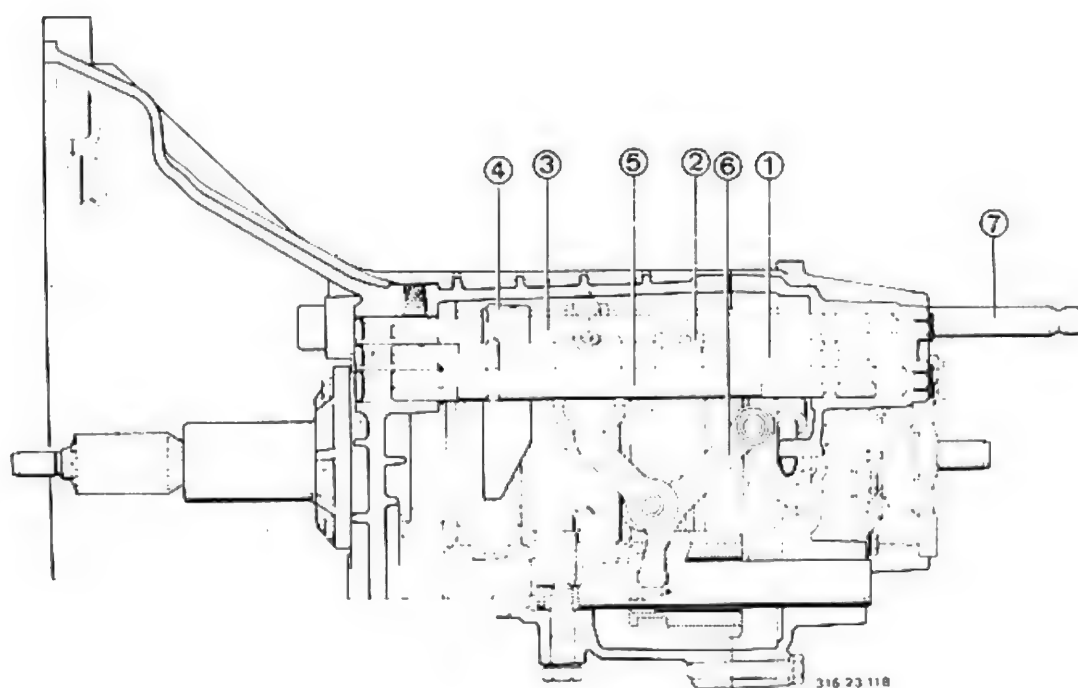


31A 23 117

ASSEMBLY DRAWING OF GETRAG 242 FOUR SPEED MANUAL TRANSMISSION

- | | | |
|---------------|----------------|----------------|
| 1 First gear | 4 Fourth gear | 6 Output shaft |
| 2 Second gear | R Reverse gear | 7 Layshaft |
| 3 Third gear | 5 Input shaft | |

23-11



ASSEMBLY DRAWING OF SHIFT MECHANISM for Getrag 242 Four Speed Manual Transmission

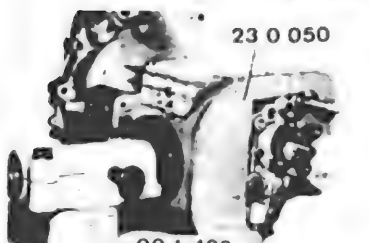
- | | |
|--------------------------------|-------------------------------|
| 1 Selector rod - 1st/2nd gear | 5 Selector rod - reverse gear |
| 2 Selector fork - 1st/2nd gear | 6 Selector lever |
| 3 Selector rod - 3rd/4th gear | 7 Selector shaft |
| 4 Selector fork - 3rd/4th gear | |

23-12



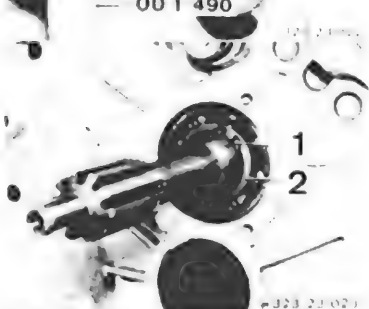
23 11 000 REMOVING AND INSTALLING/ SEALING TRANSMISSION CASE FRONT SECTION

Remove transmission — see 23 00 022 in pertinent model repair manual microfiche beginning with 1985 models.
Unscrew bracket and rubber mounts.



23 0 050

Mount transmission on Special Tools 23 0 050 and 00 1 490.
Drain oil.



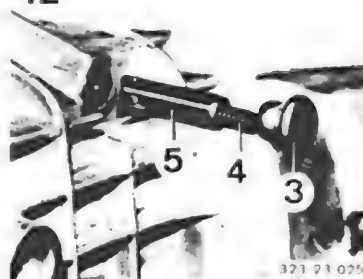
00 1 490

Remove guide sleeve — see 23 11 621.
Remove circlip (1).
Remove support (2).



23 2 010

Pull out grooved ball bearing with Special Tool 23 2 010.
Important!
Shim.



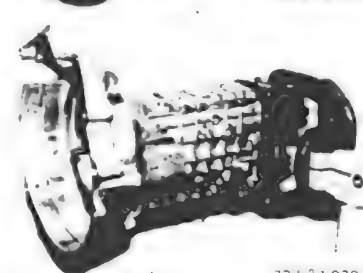
Remove cover (3).
Remove spring (4) and lockpin (5).
Check installed position.



Unscrew bolt (6).
Installation:
Install bolt with bolt cement**.
Tightening torque*.



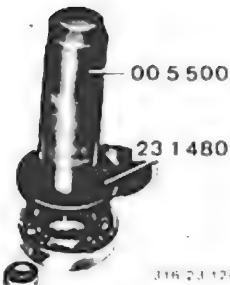
Unscrew transmission case cover mounting bolts.
Drive dowel pins (7 and 8) out of transmission case.



Pull off transmission case.
Installation:
Replace gasket.
Important!
Shims on input shaft and layshaft.

* See Specifications
** Source: HWB

23-13



Install a 1 mm (0.039") thick shim.
Drive in grooved ball bearing with Special Tools
23 1 480 and 00 5 500.
Slide case over gear wheel set.

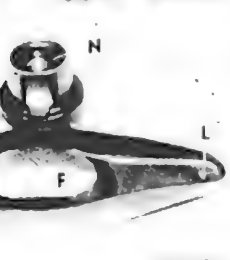


Pull input shaft into grooved ball bearing with
Special Tools 23 1 004 and 23 1 000, or push
case on to case cover.
Bolt transmission case.
Tightening torque*.
Install lockpins, shims and circlip.



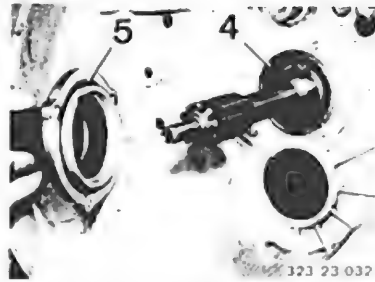
23 11 621 SEALING OR REPLACING COVER FOR CLUTCH RELEASE GUIDE TUBE — Transmission Removed —

Lift out spring (1) and remove release lever (2)
with thrust bearing (3).

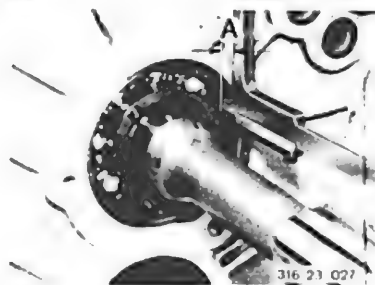


Installation
Pack lubricating groove (N) with Molykote
Longterm 2*.
Coat guides (F) and bearings (L) with Moly-
kote Longterm 2*.
Non-conformance could cause release bearing
to seize on guide sleeve.

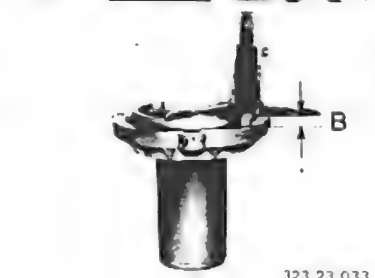
* See Specifications
** Source: HWB



Unscrew guide sleeve.
Important!
Shim (4).
Installation:
Replace O-ring (5).
Tightening torque*.



Measure distance (A) from case to grooved ball
bearing.



Measure collar height (B) of guide sleeve.
Take up any play with shims to 0 ... 0.09 mm
(0 ... 0.0035").
Example:
A 5.2 mm (0.205")
— B 4.8 mm (0.189")
0.4 mm (0.016") shim thickness

* See Specifications

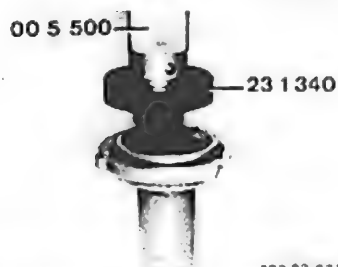
23-14

23 12 501 REPLACING RADIAL OIL SEAL FOR INPUT SHAFT — Transmission Removed —

Remove guide sleeve — see 23 11 621.
Lift out radial oil seal.



J16 73 121

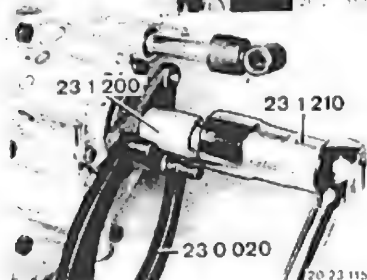


Drive in radial oil seal with Special Tools
23 1 340 and 00 5 500.
Open end faces transmission case.
Lubricate sealing lip with oil.

323 23 037

23 12 531 REPLACING RADIAL OIL SEAL FOR OUTPUT FLANGE — Transmission Removed —

Remove lockplate (1).
Installation:
Replace lockplate.

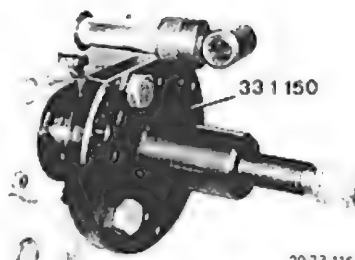


20 23 115

Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.
Installation:
Install collar nut with bolt cement**.
Tightening torque*.

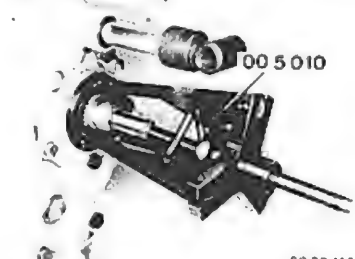
* See Specifications
** Source: HWB

Pull off output flange with Special Tool
33 1 150.



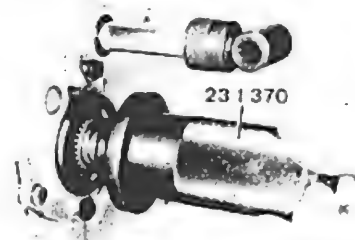
20 23 116

Pull out radial oil seal with Special Tool
00 5 010.



20 23 117

Installation:
Lubricate sealing lip with oil.
Drive in radial oil seal with Special Tool
23 1 370.



20 23 118

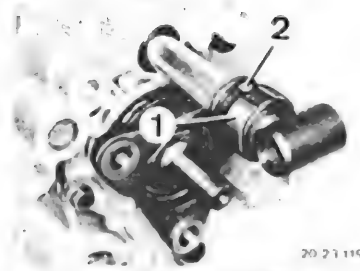
23-15

23 12 561 REPLACING RADIAL OIL SEAL FOR SELECTOR SHAFT — Transmission Removed —

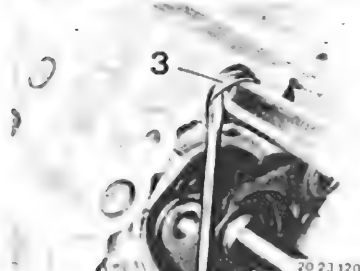
Remove locking sleeve (1).
Drive out pin (2) upwards.
Take off selector rod joint.

Installation:

Install selector rod joint that offset end of
bearing sleeve faces toward the right when
looking forward in car.



20 23 119



20 23 120

Lift out radial oil seal (3).

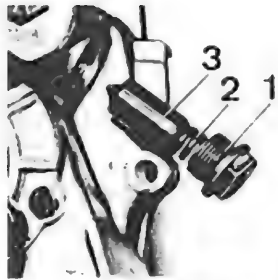


23 1 240

Lubricate sealing lip of radial oil seal with oil.
Drive in radial oil seal with Special Tool
23 1 240.

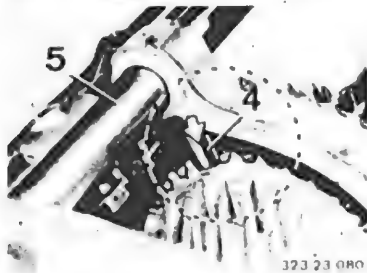
20 23 121

23-16

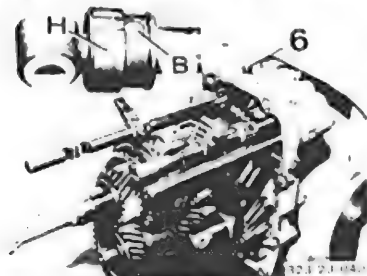


23 21 500 REMOVING AND INSTALLING INPUT AND OUTPUT SHAFTS - TRANSMISSION CASE FRONT SECTION REMOVED -

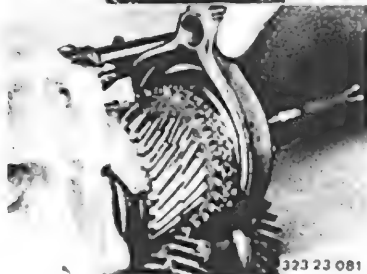
Unscrew plug (1).
Remove spring (2) and lockpin (3).
Installation:
Seal bearing surface of plug (1) with sealing compound**.



Engage 3rd gear.
Turn input shaft until opening in 3rd gear wheel is aligned with pin.
Knock out pin (4) downward in this position, until selector pin (5) can be pulled out.
Loose balls!
Important!
Knock pin between tooth flanks and operating sleeve.
Installation:
Replace pin.

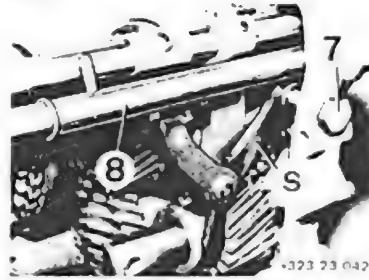


Remove key (H).
Knock out pin (B).
Unscrew bolt (6) enough that selector shaft can be turned.
Selector arm must face up.
Engage 4th gear.
Press selector fork in operating sleeve firmly and pull out selector shaft forward.
Important!
Rollers.



Remove selector fork.
Installation:
Check wear* of selector fork 23 31 501.

* See Specifications
** Source: HWB



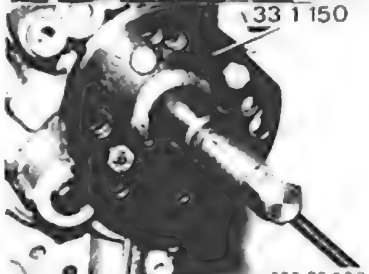
Unscrew bolt (7) enough that selector arm (S) for reverse gear can be removed.
Pull out selector rod (8).
Loose balls!



Remove lockplate.
Installation:
Replace lockplate.



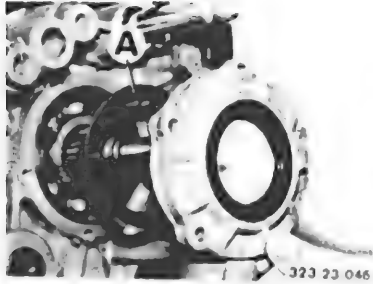
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.
Installation:
Tightening torque*.
Install collar nut with a bolt locking agent**.



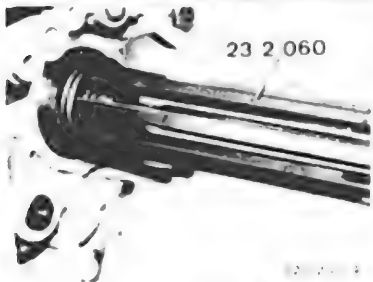
Pull off output flange with Special Tool 33 1 150.

* See Specifications
** Source: HWB

23-17

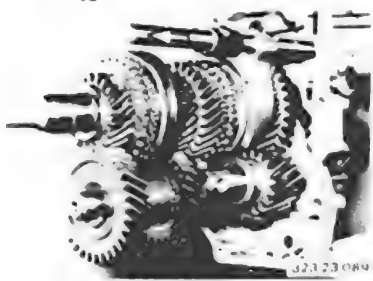


Detach support ring.
Important!
Shim (A).
Installation:
Replace gasket.
Remove old gasket with an adhesive remover*.



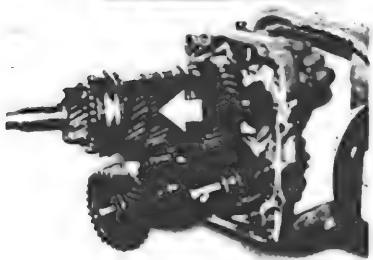
23 2 060

Pull grooved ball bearing off of output shaft and out of transmission case cover with Special Tool 23 2 060.



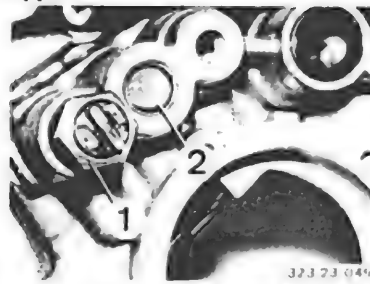
323 23 049

Drive out pin (1).
Pull out 1st/2nd gear selector rod.
Loose balls!
Remove selector fork.
Installation:
Replace pin.



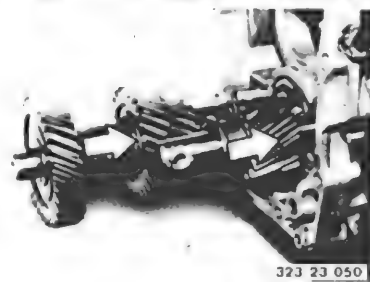
323 23 090

Remove input shaft and output shaft.
Remove layshaft.
Installation:
Check condition of all bearings, replacing if necessary (see 23 21 701).



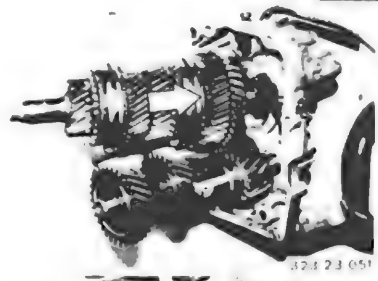
323 23 049

Remove backup light switch (1) and end cover (2).
Installation:
Push down detent balls with a screwdriver applied through open bores.
Replace end cover (2).



323 23 050

Install layshaft and reverse gear with collar facing forward.
Version with Grooved Ball Bearing:
Heat case rear section in area of ball bearing to about 80°C (176°F) with a hot air blower.



323 23 051

Insert input shaft and output shaft assembly in case rear section.

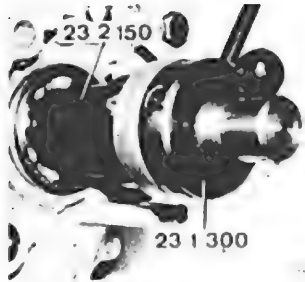


323 23 052

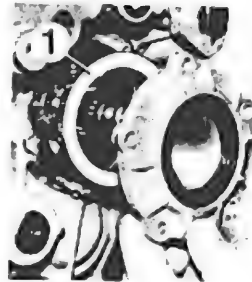
Insert grooved ball bearing in case rear section lightly.

* Source: HWB

23-18

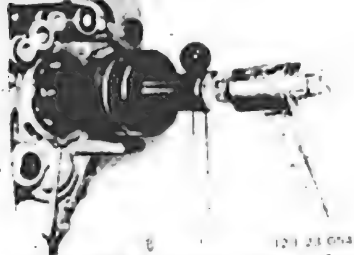


Press grooved ball bearing on output shaft and into case rear section with Special Tools 23 2 150 and 23 1 300.



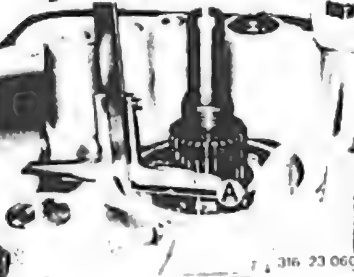
323 23 057

Drive in grooved ball bearing to fit tight by applying light knocks.



123 23 054

Measure distance (A) from case rear section to grooved ball bearing.

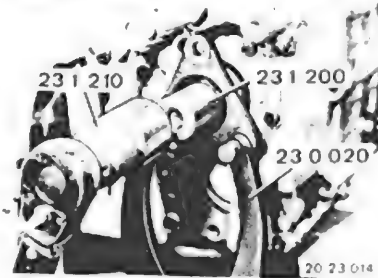


316 23 060

Measure collar height (B) without gasket.
Important!
Use 0.2 mm (0.008") for gasket thickness in calculations.



518 23 020



20 23 014

There should not be any play between grooved ball bearing and sealing cover.

All play must be taken up with shims (1).

Example:

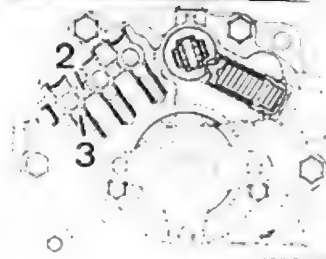
A	3.0 mm (0.118")
- B	2.8 mm (0.110")

+ 0.2 mm (0.008")
0.2 mm (0.008") gasket thickness

0.4 mm (0.016") shim thickness

Tighten sealing cover*.

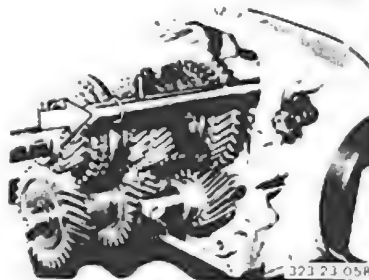
Mount output flange.
Install collar nut with bolt cement**.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Tighten collar nut with Special Tool 23 2 210.
Tightening torque*.
Install lockplate.



323 21 092

Layout of Detent and Locking Balls:
2 Locking ball
3 Detent ball

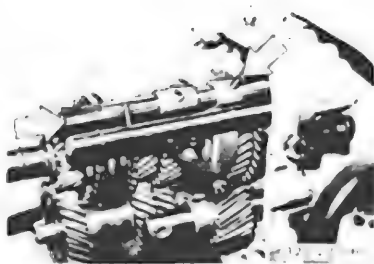
Insert detent balls.
Install selector rod for reverse gear.



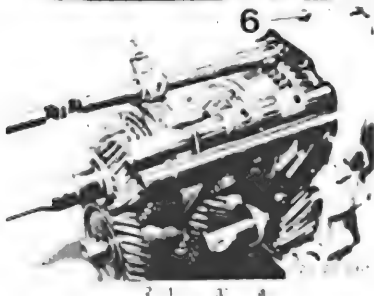
323 23 058

* See Specifications for tightening torque
** Source: HWB

23-19



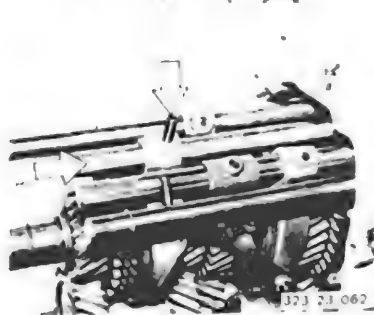
Place 1st/2nd gear selector fork in operating sleeve.
Insert locking and detent balls.
Install selector rod.
Mount selector fork with 6 x 24 mm pin.



Insert 3rd/4th gear selector fork in operating sleeve.
Engage 4th gear.
Install selector shaft; selector arm swung down.
Tighten bolt (6).
Tightening torque*.
Take out 4th gear again.



Install lockpin.
Installation
Check position of lockpin (1) in bush (2).
Insert spring (3).
Install plug (4) with sealing compound**.
Tightening torque*.



Insert locking and detent balls.
Install 3rd/4th gear selector rod.
Mount selector fork with 6 x 24 mm pin.

* See Specifications
** Source: HWB



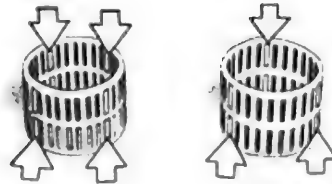
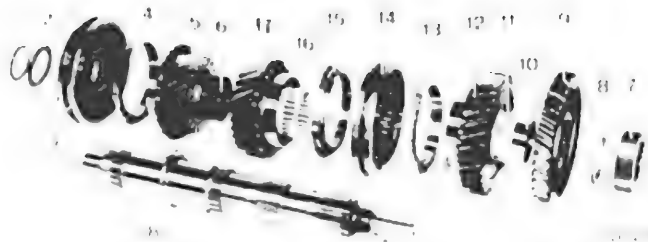
Install backup light switch (1) and end cover (2).



Install selector arm (S) for reverse gear with collar facing case.
Important!
Install selector arm without stress.
Clearance is required between selector arm and groove of reverse gear wheel.
Tightening torque*.

* See Specifications

23-20



Important!
Split needle bearings.
Slots without needles are provided in 90° and 120° steps to guarantee uniform support of the needles.

320 23 114

23 21 551 REPLACING OUTPUT SHAFT – Output Shaft Removed –

Remove circlip (1).

Installation:

Always replace circlip.

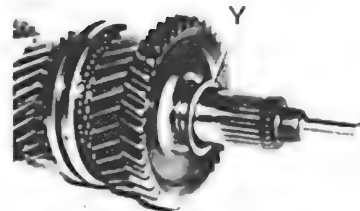
Pull support ring (2), synchronizer with sliding sleeve (3), synchronesh ring (4), 3rd gear (5) and needle cage (6) off of output shaft.

Important! - **Installation:**

Shouldered end of sliding sleeve faces 4th gear. Press spacer (7), washer (8), reverse gear (9), spacer (10), needle cage (11), 1st gear (12), synchronesh ring (13), synchronizer with sliding sleeve (14), synchronesh ring (15), needle cage (16) and 2nd gear (17) off of output shaft (18).

Installation:

Adjust play between circlip and guide sleeve to 0 ... 0.09 mm (0 ... 0.0035") with shims.

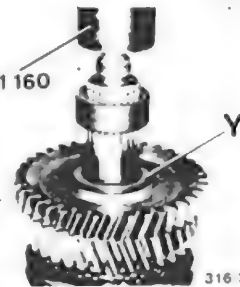


Assemble output shaft.

Important!

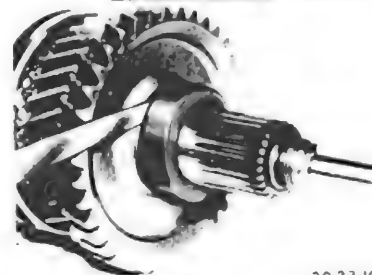
Adjust axial play to 0 ... 0.09 mm (0 ... 0.0035") with shim Y.

23 1 160



Install shim Y between reverse gear and spacer. Press spacer against collar of output shaft with Special Tool 23 1 160.

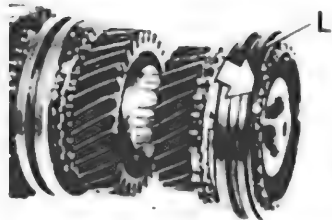
316 23 124



Check axial play.

To correct, remove reverse gear wheel again and replace shim Y with a different one.

20 23 107



320 23 114



323 23 079



2002 1306

Installation:

Sliding sleeves for 1st/2nd and 3rd/4th gears are different (splines).

Don't mix up sliding sleeves.

1 Sliding sleeve for 1st/2nd gear

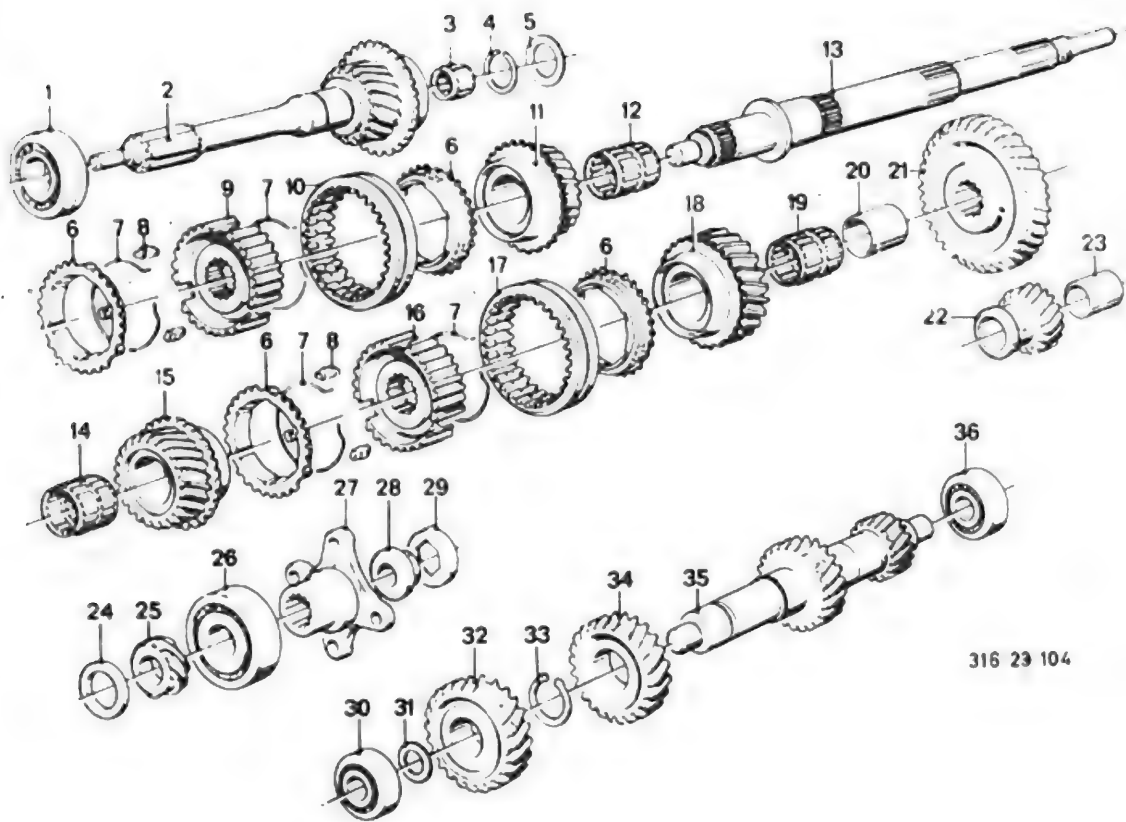
2 Sliding sleeve for 3rd/4th gear

Important!

Install sliding sleeve (2) that shouldered end faces 4th gear.

23-21

Drawing of Gear Set and Bearings:



- 1 Ball bearing
- 2 Input shaft with 4th gear
- 3 Needle bearing
- 4 Circlip
- 5 Washer
- 6 Synchromesh ring
- 7 Spring
- 8 Pressure piece
- 9 Guide sleeve 3rd/4th gear
- 10 Sliding sleeve 3rd/4th gear
- 11 3rd gear
- 12 Needle bearing
- 13 Output shaft
- 14 Needle bearing
- 15 2nd gear
- 16 Guide sleeve 1st/2nd
- 17 Sliding sleeve 1st/2nd gear
- 18 1st gear
- 19 Needle bearing
- 20 Bush
- 21 Reverse gear
- 22 Reverse gear
- 23 Bush
- 24 Washer Y
- 25 Spacer
- 26 Ball bearing
- 27 Output flange
- 28 Collar nut
- 29 Lockplate
- 30 Ball bearing
- 31 Washer
- 32 4th gear
- 33 Circlip
- 34 3rd gear
- 35 Layshaft
- 36 Roller bearing

316 23 104

23-22

23 21 701 REPLACING BEARINGS OF ALL TRANSMISSION SHAFTS — Transmission Removed —

Remove and install input and output shafts
— see 23 21 500.

A) Layshaft:

Pull off bearing inner race or grooved ball bearing on layshaft.
Press new bearing inner race and grooved ball bearing on layshaft, without shim.

12 1 210 000



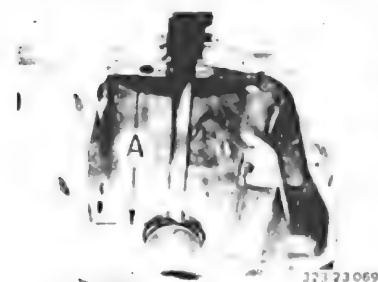
Heat case rear section in area of bearing to about 80°C (176°F) with hot air blower.
Pull out cylindrical roller bearing.

Installation

Large diameter end of roller cage faces case rear section.

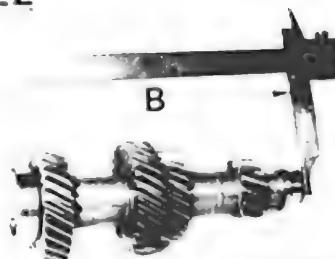
12 1 210 000

Determine thickness of shim C.



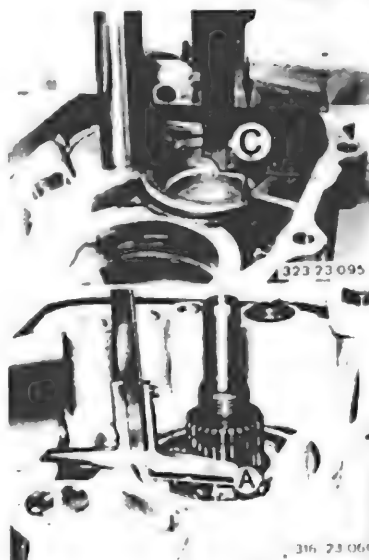
323 23 069

Remove grooved ball bearing in case front section after heating case front section in area of bearing to about 80°C (176°F) with a hot air blower.
Measure distance (A) from case sealing surface to circlip.



12 1 210 000

Measure distance (B) from bearing inner race to ball bearing inner race.



323 23 095

Measure distance C from case sealing surface to bearing outer race on cover without gasket.
Use 0.2 mm (0.008") for gasket thickness in calculations.

Example:

A	170.0 mm (6.693")
+ C	38.7 mm (1.523")
+ 0.2 mm (0.008") gasket thickness	
<hr/>	
208.9 mm (8.224")	
– B	208.5 mm (8.208")
<hr/>	
0.4 mm (0.016")	
– 0.1 ... 0.2 mm (0.004 ... 0.008") axial play	
<hr/>	
0.2 ... 0.3 mm (0.008 ... 0.012") shim th.	

B) Output Shaft:

Measure distance A from case cover to grooved ball bearing.



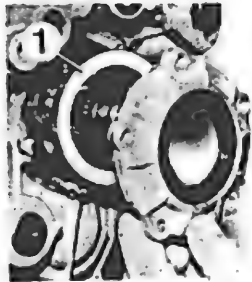
518 23 112

Measure collar height B without gasket.

Important!

Use 0.2 mm (0.008") for gasket thickness in calculations.

23-23



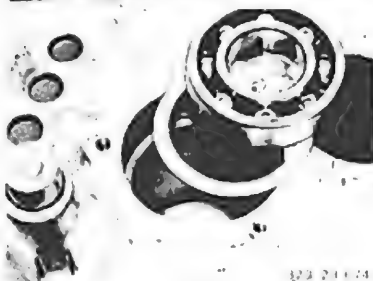
323 23 057

There should not be play between grooved ball bearing and sealing cover.
Take up all play with shims (1).

Example:

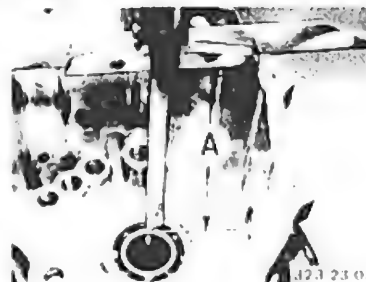
A	3.0 mm (0.118")
- B	2.8 mm (0.110")
	0.2 mm (0.008")
+	0.2 mm (0.008") gasket thickness
	0.4 mm (0.016") shim thickness

Tighten sealing cover.
Mount and lock output flange.



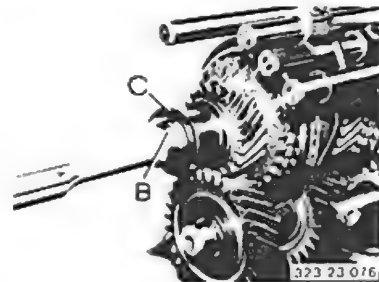
323 23 074

C) Input Shaft:
Install a 1 mm (0.039") shim and drive in grooved ball bearing with Special Tools 23 1 480 and 00 5 500.



323 23 075

Measure distance A from case sealing surface to grooved ball bearing.

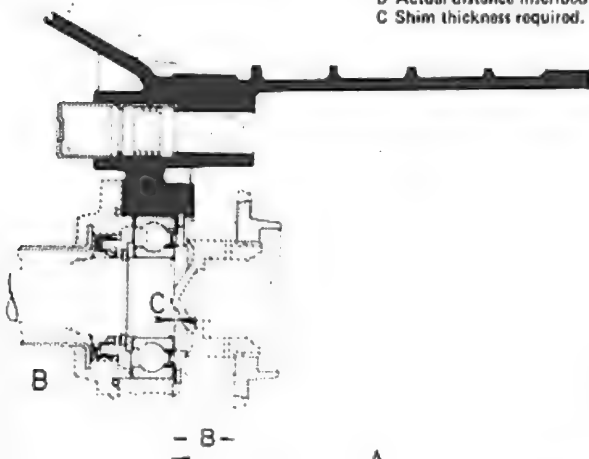


323 23 076

After having actual distances A and B the thickness of shim C can be read in the "C" column.

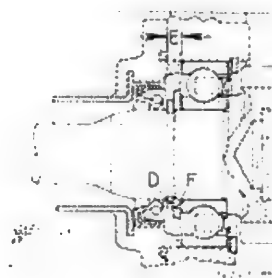
A mm	B mm	Inscribed Lines	C mm
159.9	24	3 or 4	0.5
	23.9	1 or 2	0.6
159.8	24	3 or 4	0.4
	23.9	1 or 2	0.5
159.7	24	3 or 4	0.3
	23.9	1 or 2	0.4
159.6	24	3 or 4	0.3
	23.9	1 or 2	0.3

Install shim C on input shaft.



A

323 23 085



Measure circlip thickness D.
Insert circlip in groove of input shaft.
Measure distance E from circlip to grooved ball bearing.

Determine support ring thickness F.

Example:

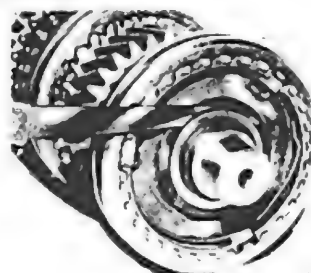
E	4.1 mm (0.161")
- D	1.8 mm (0.071")
F	2.3 mm (0.090")

Install support ring F.

23-24

23 22 551 REPLACING 3RD AND 4TH GEAR WHEEL SET — Output Shaft Removed —

Pull input shaft with needle cage (1) and synchromesh ring (2) off of output shaft.



Installation:
Adjust play between circlip and guide sleeve to 0 ... 0.09 mm (0 ... 0.0035") with shims.

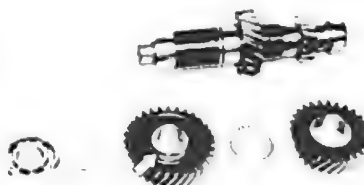
Remove circlip (3).
Pull off support ring (4), guide sleeve (5), synchromesh ring (6) and 3rd gear (7) with needle cage (8).

Installation:

Replace circlip.

Important!

Shouldered end of sliding sleeve (5) faces 4th gear.



Press 4th gear and grooved ball bearing off of layshaft.

Important!

Shims.

Remove circlip and press off 3rd gear.

Pressing off force: approx. 10 tons.

Pressing on force: approx. 7 tons.

Installation:

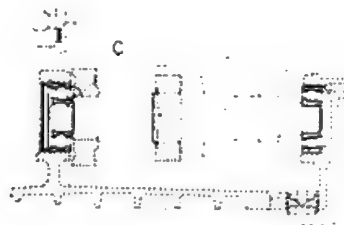
Heat gears to 120 ... 150°C (250 ... 300°F) with a hot air blower.

Important!

High collar at bore of 3rd and 4th gears faces toward 2nd gear.

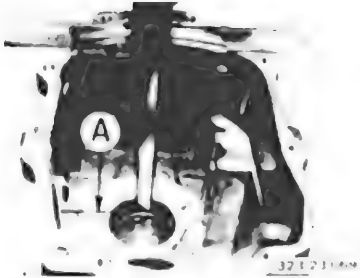
316 23 091

Determine thickness of shim C.

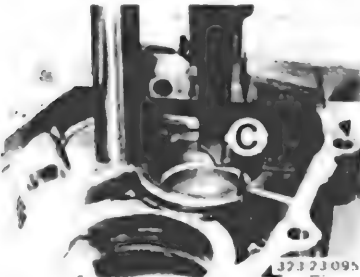


23-25

Measure distance A from case sealing surface to circlip.



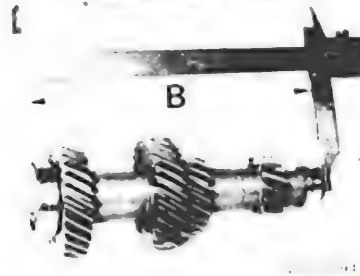
Measure distance C from case sealing surface to bearing outer race on cover without gasket.
Use 0.2 mm (0.008") for gasket thickness in calculations.



Measure distance B from bearing inner race to ball bearing inner race.

Example:

A	170.0 mm (6.693")
+ C	38.7 mm (1.523")
+ 0.2 mm (0.008") gasket thickness	
	<hr/>
	208.9 mm (8.224")
- B	208.5 mm (8.208")
	<hr/>
	0.4 mm (0.016")
- 0.1... 0.2 mm (0.004...0.008") axial play	
	<hr/>
0.2 ... 0.3 mm (0.008...0.012") shim thickness	



23-26

23 23 503 DISASSEMBLING/ASSEMBLING COMPLETE SYNCHRONIZATION — Transmission Removed —

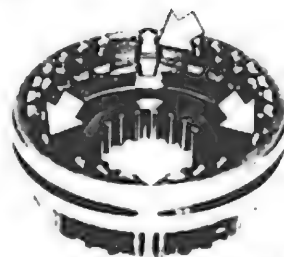
Remove output shaft — see 23 21 500.
Visually inspect synchronesh rings for wear.
Synchronesh rings must be replaced when
distance between synchronesh ring and clutch
unit is less than 1.0 mm (0.039").

Important!

Measure in area of stops.

Synchronesh rings should have uniform con-
tact all around.

316 23 095

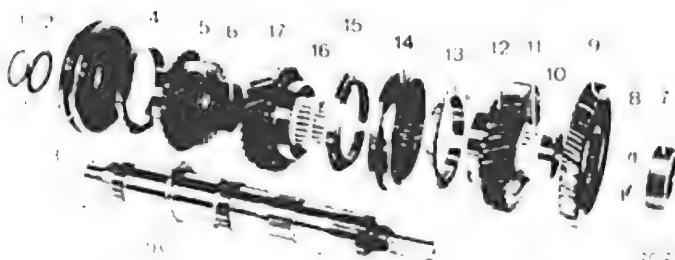


316 23 124

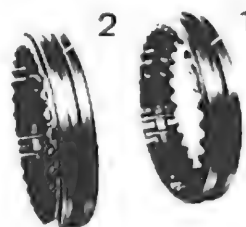
Press sliding sleeve off of synchronizer.

Installation

Push flat teeth of sliding sleeve over thrust
pieces.



23 21 504



Installation

Sliding sleeves for 1st/2nd gear and 3rd/4th gear
are different (splines).

Don't mix up sliding sleeves.

1 Sliding sleeve for 1st/2nd gear

2 Sliding sleeve for 3rd/4th gear

Important!

Install sliding sleeve(2) that shouldered end
faces 4th gear.

Remove circlip (1).

Installation

Always replace circlip.

Pull support ring (2), synchronizer with sliding
sleeve (3), synchronesh ring (4), 3rd gear (5)
and needle cage (6) off of output shaft.

Press spacer (7), washer (8), reverse gear (9),
spacer (10), needle cage (11), 1st gear (12),
synchronesh ring (13), synchronizer with slid-
ing sleeve (14), synchronesh ring (15), needle
cage (16) and 2nd gear (17) off of output
shaft (18).

Important!

Split needle bearings:

Slots are provided without needles in steps of
90° or 120° to guarantee uniform support of
the needles.



Offset hooks of synchroneshing springs in
an axial groove to each other.

Connect thrust pieces in synchroneshing springs.

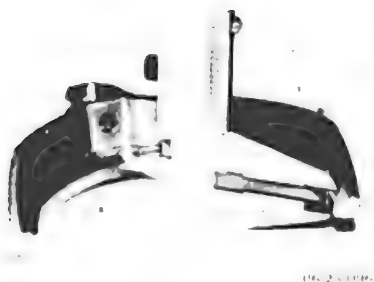


320 23 113

23-27

23 31 501 REPLACING 1ST/2ND AND 3RD/ 4TH GEAR SELECTOR FORKS

Remove input and output shafts 23 21 500.
Check wear* of selector forks.



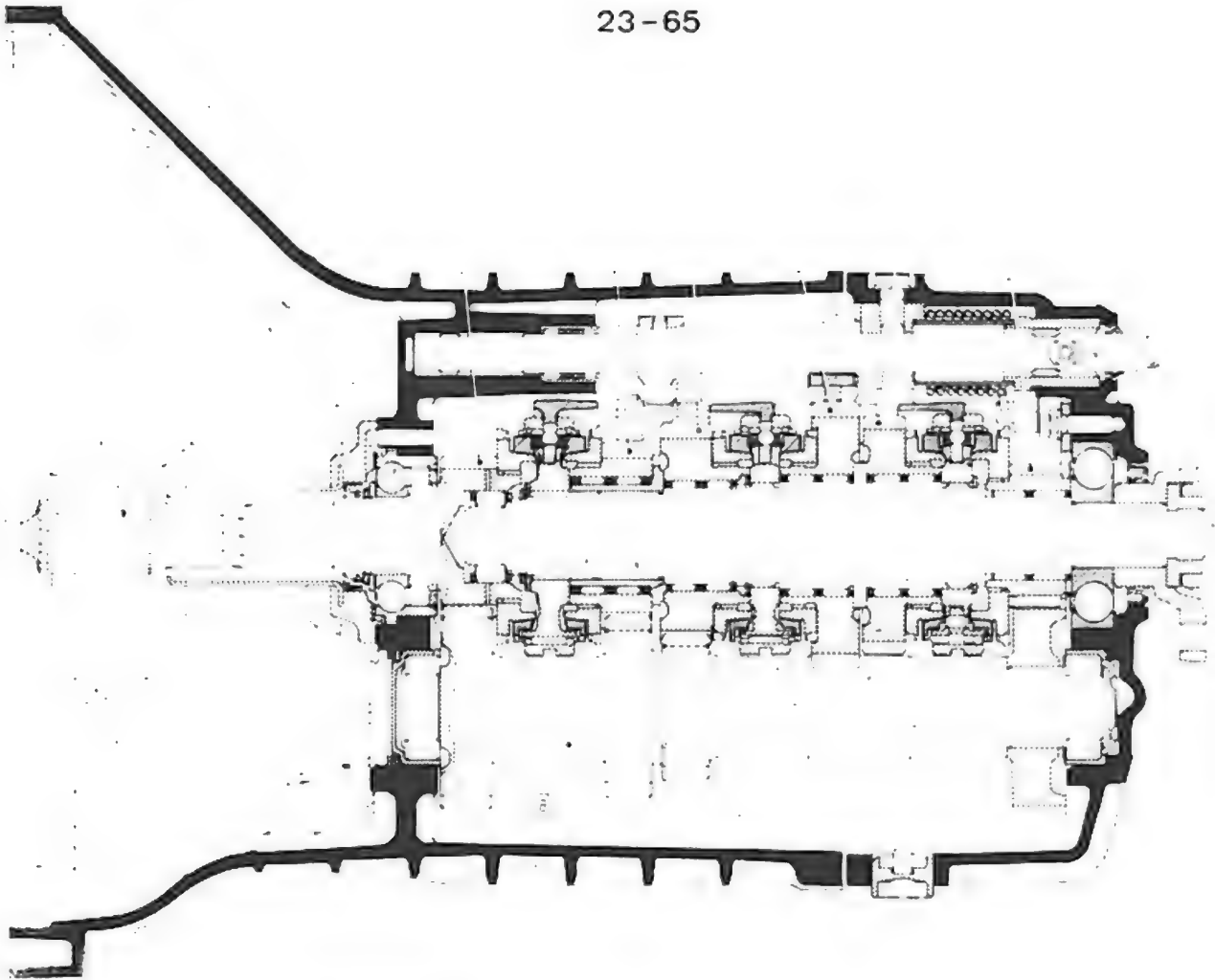
* See Specifications

Construction group 23 Manual transmission

Getrag 240 Manual transmission (overdrive)

	Assembly drawing – transmission	23-	65
	Assembly drawing – shift components	23-	66
23 11 013	Transmission case front section – remove and install / seal	23-	67
623	Guide sleeve for clutch release – remove and install	23-	68
23 12 503	Radial oil seal for input shaft – replace	23-	68a
23 21 503	Input and output shaft assembly – remove and install	23-	69
554	Output shaft – replace	23-	74
703	Bearings of all transmission shafts – replace	23-	77
23 23 505	Synchronisation – disassemble and assemble	23-	81

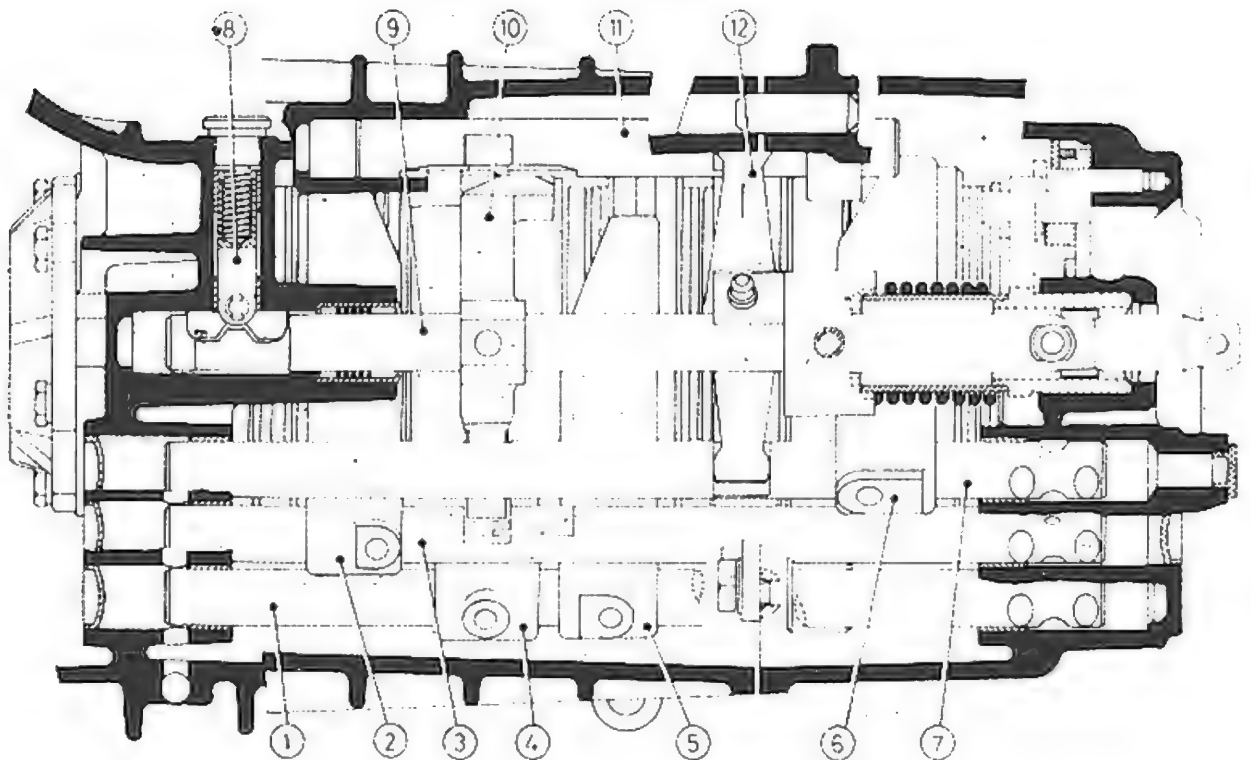
23-65



ASSEMBLY DRAWING OF GETRAG 240 FIVE SPEED OVERDRIVE MANUAL TRANSMISSION

- | | | |
|---------------|----------------|----------------|
| 1 First gear | 4 Fourth gear | 6 Input shaft |
| 2 Second gear | 5 Fifth gear | 7 Output shaft |
| 3 Third gear | R Reverse gear | 8 Layshaft |

23-66



ASSEMBLY DRAWING OF SHIFT PARTS FOR 240 FIVE SPEED OVERDRIVE MANUAL TRANSMISSION

- | | | |
|-------------------------------|-----------------------------------|--------------------|
| 1 Selector rod, 1st/2nd gear | 5 Selector fork, 1st/2nd gear | 9 Selector shaft |
| 2 Selector fork, 3rd/4th gear | 6 Selector fork, reverse/5th gear | 10 Selector arm |
| 3 Selector rod, 3rd/4th gear | 7 Selector rod, reverse/5th gear | 11 Selector rail |
| 4 Dog | 8 Lockpin | 12 Operating lever |

23-67

23 11 013 REMOVING AND INSTALLING/ SEALING FRONT TRANSMISSION CASE SECTION

Remove transmission — see pertinent model
repair manual microfiche since 1985 models
— 23 00 022.
Mount Special Tool 23 0 090 on Special Tool
00 1 490.
Mount transmission on special tool.
Drain oil.

Remove guide sleeve 23 11 623.
Unscrew backup light switch.
Remove cap (1).
Pull out spring (2) and lockpin (3).
Check installed position!

Remove snap ring (4).
Remove washer (5).
Installation:
Always replace circlip.

Unscrew bolt (6).
Installation:
Install bolt with a bolt cement**.
Tightening torque*.

* See Specifications
** Source: HWB

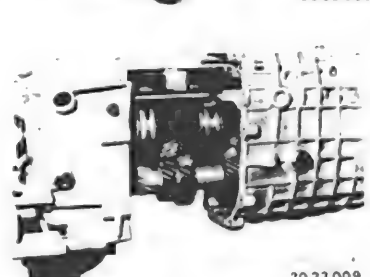
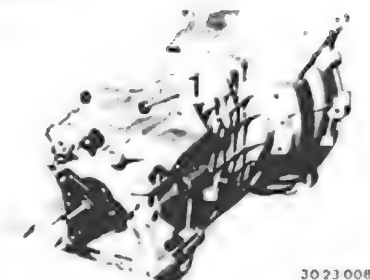
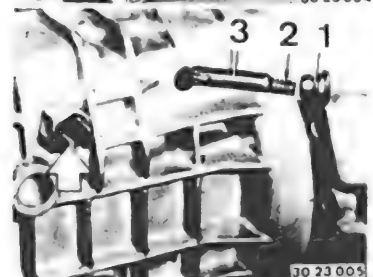
Drive out dowel pins.
Unscrew bolts.
Installation:
Check length of bolts.
Bolt (1) = 8 x 60 mm.

Pull off case front section.
Installation:
Coat sealing surface with sealing compound**.
Sealing surface must be thoroughly clean and
dried of oil.

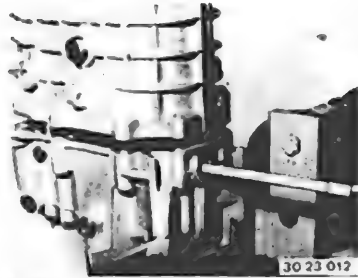
Install roller bearing on layshaft that small
diameter end faces up.

Coat case front section in area of reverse gear
shaft with sealing compound**.
Surface must be thoroughly clean and dried
of oil.

** Source: HWB



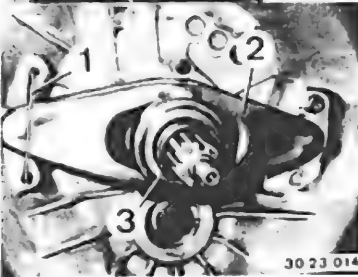
23-68



Unscrew oil drain plug.
Mount case front section.
Align layshaft through bore for oil drain plug that roller bearing of layshaft slides into bearing shell.
Mount case front section.
Tightening torque*.
Install lockpin.

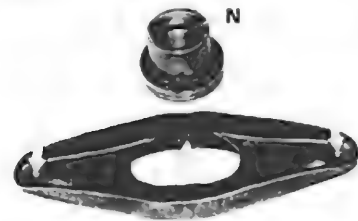


Install spacer and circlip.
Adjust play between bearing race and circlip to 0 ... 0.09 mm (0 ... 0.0035").



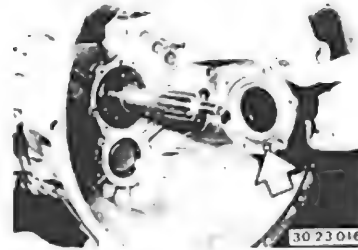
23 11 623 REMOVING AND INSTALLING GUIDE SLEEVE FOR CLUTCH RELEASE — Transmission Removed —

Lift out spring (1) and remove release lever (2) with thrust bearing (3).



Installation:
Pack lubricating groove (N) with Molykote Longterm 2.
Coat guides (F) and bearings (L) with Molykote Longterm 2.
Non-conformance could cause release bearing to seize on guide sleeve.

* See Specifications



Detach guide sleeve.
Important!
Spacer.

Installation:
Install guide sleeve with sealing compound**. Sealing surface must be thoroughly clean and dried of oil.



Installation:
Adjust play to 0 ... 0.09 mm (0 ... 0.0035").
Determine thickness of spacer.
Measure distance (B) from guide sleeve protrusion to inside surface.



Measure distance (C) from guide sleeve protrusion to outside surface.

Example:

B	4.0 mm (0.157")
— C	2.6 mm (0.102")
	1.4 mm (0.055") spacer thickness

** Source: HWB

23-68 a

23 12 503 REPLACING RADIAL OIL SEAL FOR INPUT SHAFT - Transmission Removed -

Remove guide sleeve - see 23 11 622.
Lift-out radial oil seal.

320 23 048

00 5 500

23 1 360

Drive in radial oil seal with Special
Tools 23 1 360 and 00 5 500.
Open end faces up.
Lubricate sealing lip with oil.

23-69

23 21 503 REMOVING AND INSTALLING INPUT AND OUTPUT SHAFT ASSEMBLY —TRANSMISSION REMOVED—

Remove transmission case front section
23 11 013.
Remove lockplate.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.

Pull off output flange with Special Tool
33 1 150.

Unscrew bolt (1).
Remove holder (2).
Unscrew bolt (3).

Remove shaft with reverse gear and
needle bearing.

Pull out pin (4) for operating lever (5).
Pull out selector rail (6).
Remove operating lever (5).

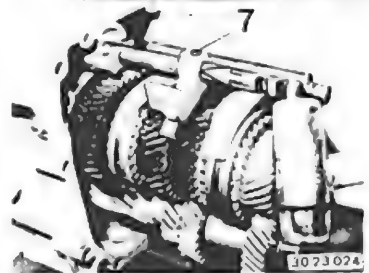
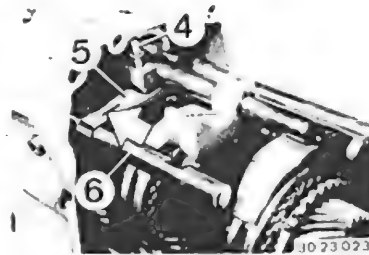
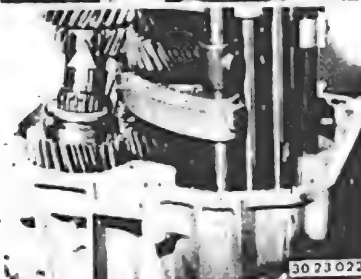
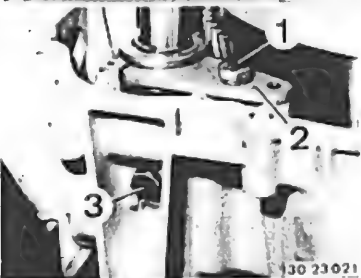
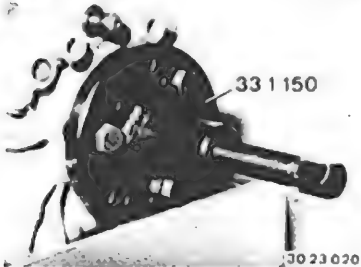
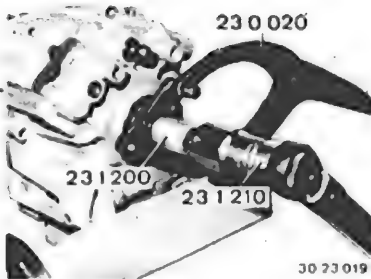
Installation
Install operating lever that notch faces up and
in direction of selector rail.

Engage 4th gear.
Drive in pin (7), while counterholding.
Important!
Only drive in pin (7) far enough that selector
shaft can be pulled back and out.

Radial oil seal (8) will also be pulled out.
Important!
Rollers on selector shaft.
Installation
Replace radial oil seal.
Remove selector arm.

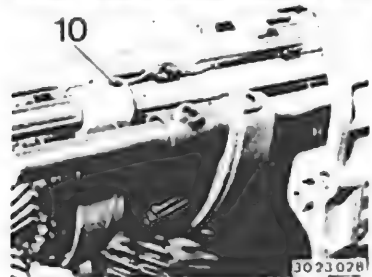
Detach end plate.
Installation
Install end plate with sealing compound**.
Sealing surface must be thoroughly clean
and dried of oil.
Remove end plate (9).
Installation
Replace end plate.

** Source: HWB



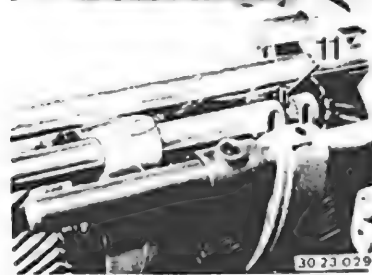
23-70

Remove three springs.



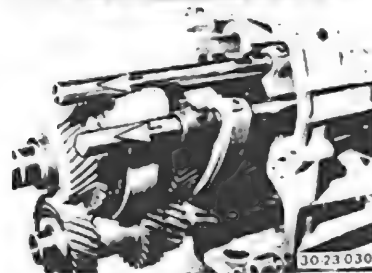
Drive pin (10) out of the 3rd/4th gear shift fork.

Installation:
Install a new pin.

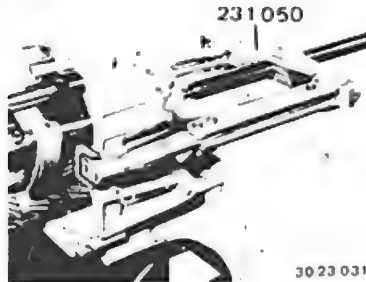


Knock out 3rd/4th gear shift rod forward.

Important!
Lockpin (11) in shift rod.



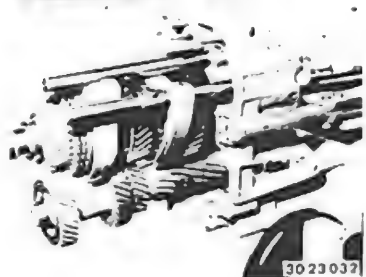
Engage 2nd and reverse gears by moving 1st/2nd and 5th/reverse gear shift rods forward.



23 1 050

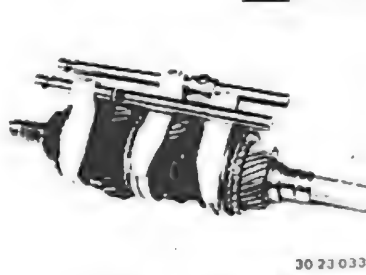
Press input shaft, output shaft and layshaft out of the rear case section with Special Tool 23 1 050.

Important!
Use a piece of wood, aluminum or something similar between the claws of the special tool and sealing surface, to avoid damaging the sealing surface.

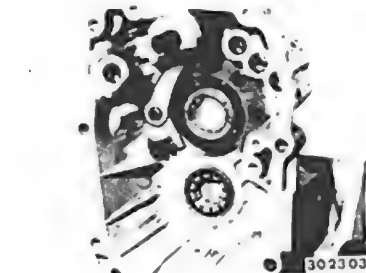


Important!
Make sure that shift rods and the layshaft do not clamp while pressing out. The layshaft must not fall down in this step.

Installation:
Check condition of all bearings, replacing if necessary.



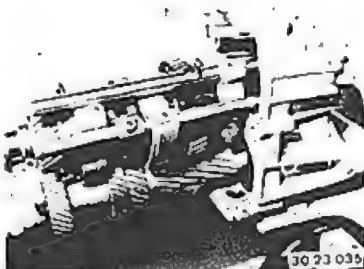
Installation:
Install 3rd/4th gear shift fork and shift rods with shift forks for 1st/2nd and 5th/reverse gears.



Remove all locking and detent balls in rear case section.
Install the roller bearing with the large diameter end facing out.
Lubricate lockpins and locking arms with oil.

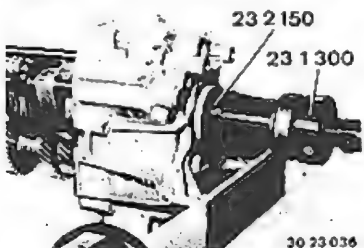
23-71

Heat grooved ball bearing inner race in case rear section to approx. 80° C (175° F) with a hot air blower. Second and reverse gears are engaged. Insert input shaft, output shaft and layshaft in case rear section. Align selector rods.



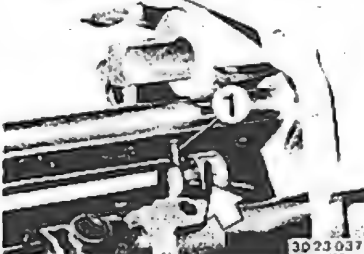
Pull input shaft, output shaft and layshaft into case rear section with Special Tools 23 1 300 and 23 2 150.

Important!
Make sure selector rods and layshaft are not clamped while pulling in parts.

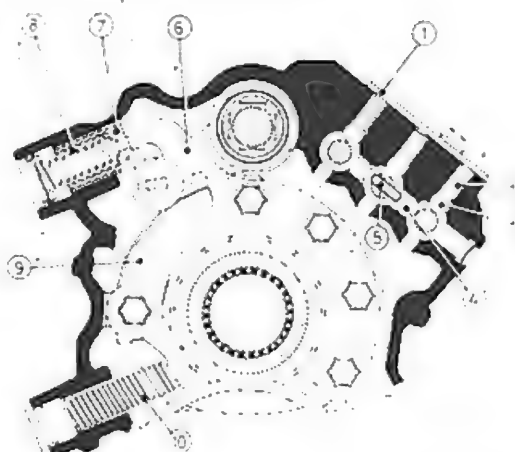


Move selector rods to neutral position. Slide 3rd/4th gear selector rod through selector forks.

Install lockpin (1) in selector rod with grease. Push in selector rod up to bore. Opening in selector rod faces up.



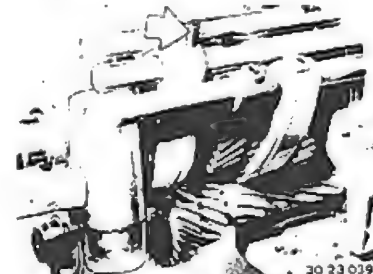
Install two detent balls with grease. Push in 3rd/4th gear selector rod against lock.



Arrest Assembly:

- 1 End cover
- 2 Spring
- 3 Locking ball
- 4 Detent ball
- 5 Lockpin
- 6 Selector arm
- 7 Lockpin
- 8 Spring
- 9 Locking screw
- 10 Spring

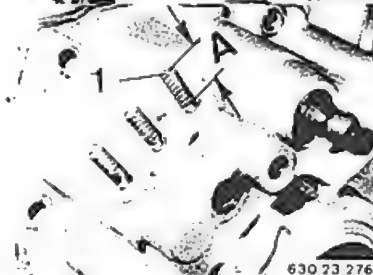
Drive 6 x 24 mm pin into 3rd/4th gear selector fork (counterhold).



Install 3 locking balls and 3 springs.

Important!

Version with Different Length Springs:
Install the short spring (1) with relaxed length (A) = 15.9 mm (0.626") for 5th/reverse gear selector rod.



23-72



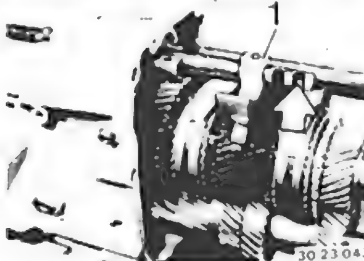
30 23 041

Install end cover after coating with sealing compound**.
Install end cover with sealing compound**.



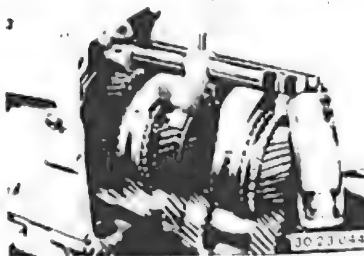
30 23 042

Drive pin out of selector arm.



30 23 043

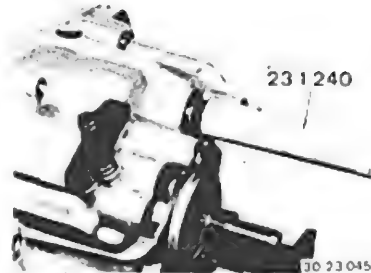
Hold 4 rollers in position with grease.
Slide in selector shaft and install selector arm (1) at same time.
Important!
Opening in selector shaft faces out.



30 23 044

Drive in 6 x 26 mm pin (counterhold).

** Source: HWB



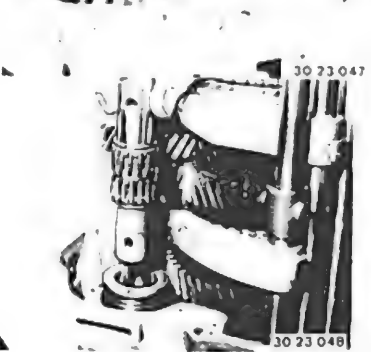
23 1 240

Lubricate sealing lips of radial oil seal with oil.
Drive in radial oil seal with Special Tool 23 1 240.



30 23 045

Install selector rail.
Groove (1) in selector rail faces up.
Install operating lever (5) with notch facing up and toward selector rail.
Install pin (4).



30 23 046

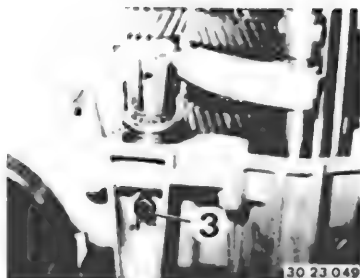
Coat case rear section in area of reverse gear shaft with sealing compound**. Surface must be thoroughly clean and dried of oil.

30 23 047

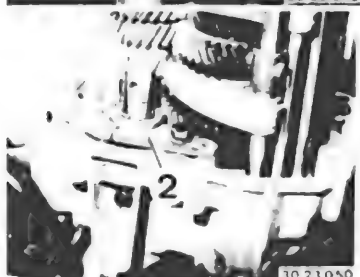
Install shaft with needle bearing and reverse gear.

** Source: HWB

23-73



Mount shaft with bolt (3).
Install bolt with a locking compound**.



Insert holder (2), press out and secure in this position.



Install output flange.
Install collar nut with a locking compound*.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Tighten* collar nut with Special Tool 23 1 210.



Install lockplate.

* See Specifications for tightening torque
** Source: HWB

23-74

23 21 554 REPLACING OUTPUT SHAFT - Output Shaft Removed -

Pull off Input shaft (1), synchronesh ring (2) and needle bearing (3).

Note:
To avoid mixing up the synchronesh rings while disassembling the output shaft, it is recommended to mark the synchronesh rings for a pertinent gear wheel.

Pull off 5th gear wheel (4), synchronesh ring (5) and needle bearing (6).

Lift out circlip (7).
Take off spacer (8).

Installation:
Always replace the circlip.

Installation:
Adjust play between the circlip and guide sleeve to 0 ... 0.09 mm (0 to 0.0035").

Press off 3rd gear wheel, guide and operating sleeves with Special Tool 23 1 490.
Take off needle bearing.
Pressing-off force*.

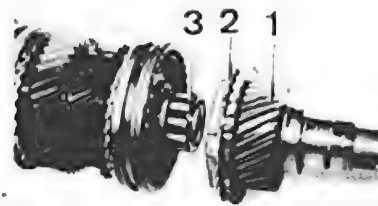
Press off bearing sleeve and 2nd gear wheel with Special Tool 23 1 490.
Remove needle bearing and synchronesh ring.

Important!
Circlip (10) must be removed before pressing off the 1st gear wheel.

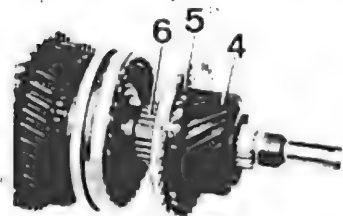
Installation:
Always replace the circlip.

Press off 1st gear wheel, guide and operating sleeves with Special Tool 23 1 490.
Take off needle bearing.
Pressing-off force*.

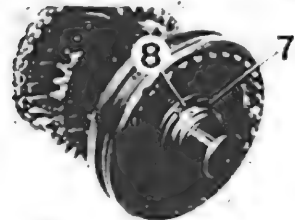
* See Specifications



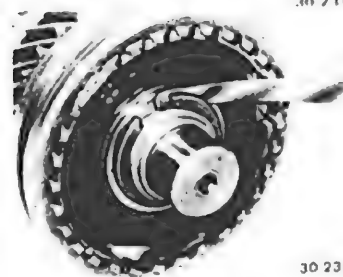
30 23 051



30 23 052



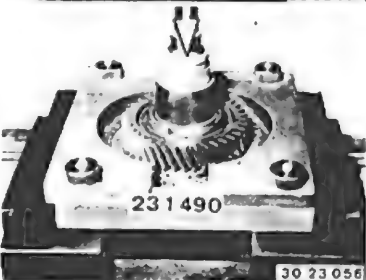
30 21 053



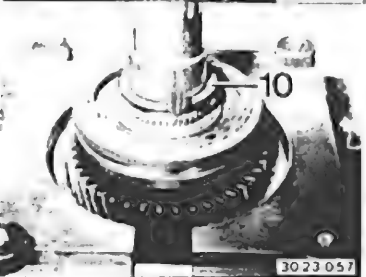
30 23 054



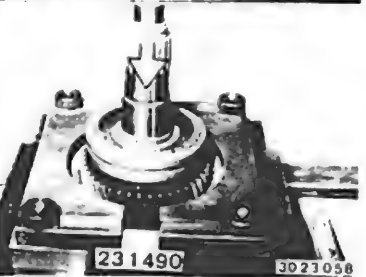
30 23 055



30 23 056



30 23 057



30 23 058

23-75

Important!
Circlip (11) must be removed prior to pressing off the reverse gear wheel.

Installation:
Always replace the circlip.

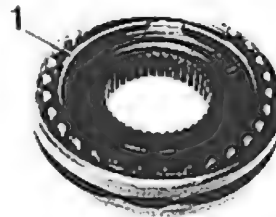
Place output shaft next to the collar.

Press guide and operating sleeves as well as reverse gear wheel off of the output shaft.
Take off needle bearing.
Pressing-off force*.

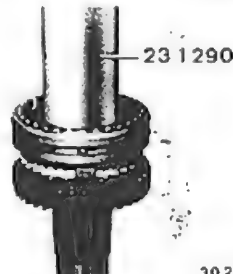
Assembling:

Note:
Check wear of synchromesh rings prior to assembling (see 23 23 505).
Install needle bearing, reverse gear wheel and synchromesh ring (only for version with synchronized reverse gear).
Insert guide and operating sleeves on splines of the output shaft.
Important!
Version with 3 Identification Grooves:
Grooves must face the 5th gear wheel.

* See Specifications



30 23 063



30 23 064



30 23 065



30 23 066

Important!
Version without Synchronized Reverse Gear:
Retainer (1) in the guide sleeve faces the reverse gear wheel.

Press on guide sleeve to fit tight with Special Tool 23 1 290.
Pressing-on force*.

Important!
Make sure that tabs on the synchromesh ring are aligned with openings in the guide sleeve while pressing on.

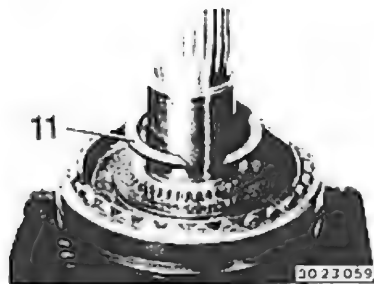
Shift operating sleeve in direction of the reverse gear wheel.
Adjust guide sleeve to be without play with circlip (11).
Circlips are available from Parts in different thicknesses from 1.7 to 2.0 mm (0.067 to 0.079").
Install circlip (11).

Install needle bearing, 1st gear wheel and synchromesh ring.
Slide guide and operating sleeves on splines of the output shaft.

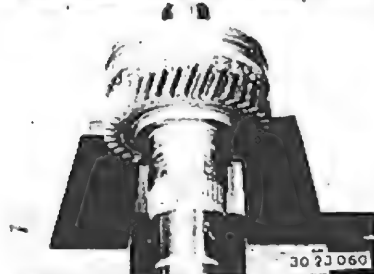
Shouldered Operating Sleeve, Version:
Shouldered end faces 2nd gear wheel.

Version with Identification Groove:
Groove faces 1st gear wheel.

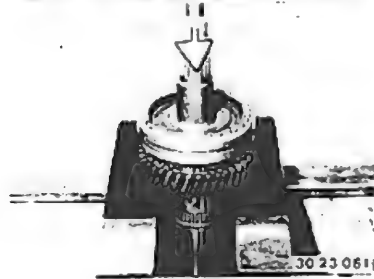
* See Specifications



30 23 059



30 23 060

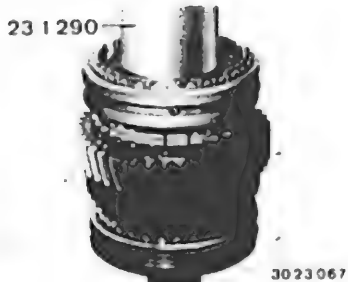


30 23 061



30 23 062

23-76



30 23 067

Press on guide sleeve to fit tight with Special Tool 23 1 290. Pressing-on force*.

Important!
Make sure that tabs on the synchromesh ring are aligned with openings in the guide sleeve while pressing on.

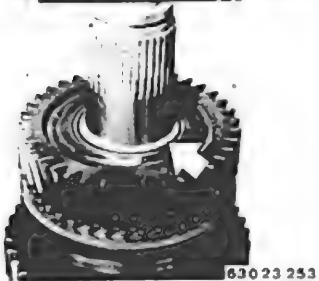
Shift operating sleeve in direction of the 1st gear wheel.
Adjust guide sleeve to be without play. Circlips are available from Parts in different thicknesses from 1.7 to 2.0 mm (0.067 to 0.079"). Install circlip (10).



30 23 068

Install needle bearing, synchromesh ring and 2nd gear wheel.

Important!
Collar for the bearing sleeve on the output shaft must protrude slightly. If necessary, check circlip (10) for correct sealing.



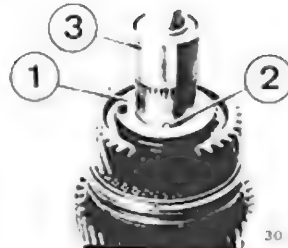
30 23 253



30 23 071

Heat bearing sleeve to about 80° C (175° F) with a hot air blower and install on the output shaft.

* See Specifications



30 23 14

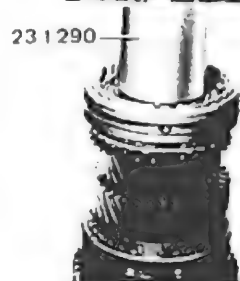
Version with Thrust Washer:
Install thrust washer (1) and ball (2). Heat bearing sleeve (3) without collar to about 80° C (175° F) with a hot air blower and install on the output shaft.



30 23 072

Install needle bearing, 3rd gear wheel and synchromesh ring. Install guide and operating sleeves on the splines with the groove facing the 4th gear wheel.

Version with 2 Identification Grooves:
Grooves face the 3rd gear wheel.



30 23 073

Press on guide sleeve to fit tight with Special Tool 23 1 290.

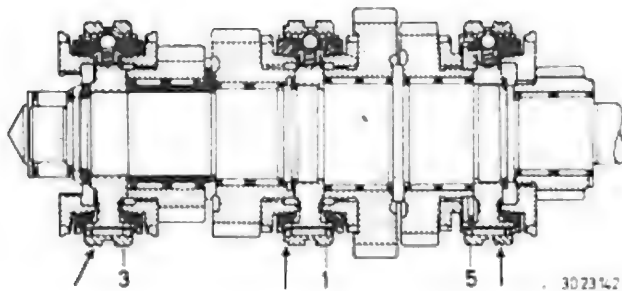
Important!
Make sure that tabs on synchromesh ring are aligned with openings in the guide sleeve while pressing on.

Install spacer and circlip.

Pressing-on force*.

* See Specifications

23-76a



Identification and Installed Location of Operating Sleeves:

Date of introduction: 8.85

Operating sleeve (1) for 1st/2nd gears.

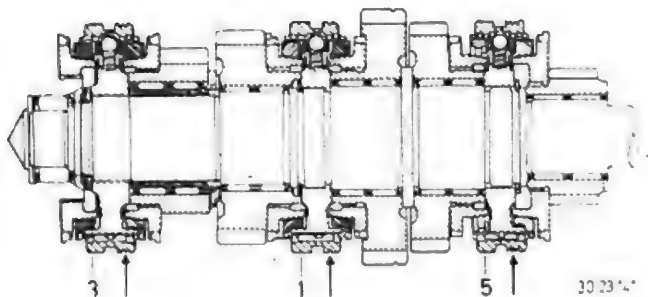
Operating sleeve installed with shouldered end facing 2nd gear wheel.

Operating sleeve (3) for 3rd/4th gears with one identification groove.

Operating sleeve installed with groove facing 4th gear wheel.

Operating sleeve (5) for 5th/reverse gears with two identification grooves.

Operating sleeve installed with grooves facing 5th gear wheel.



Important!

Modified synchronization since 11.87 with new gear wheels, synchromesh rings, guide and operating sleeves, guides, ball and springs.

Identification and Installed Location of Operating Sleeves:

Operating sleeve (1) for 1st/2nd gears with one identification groove.

Operating sleeve installed with groove facing 1st gear wheel.

Operating sleeve (3) for 3rd/4th gears with two identification grooves.

Operating sleeve installed with grooves facing 3rd gear wheel.

Operating sleeve (5) for 5th/reverse gears with three identification grooves.

Operating sleeve installed with grooves facing 5th gear wheel.

Important!

Modified shift components may not be installed in older transmissions (shifting problems).

23-77

23 21 703 REPLACING BEARINGS OF ALL TRANSMISSION SHAFTS - Transmission Removed -

Remove Input/output shaft assembly - see 23 21 503.

A) Input Shaft, Layshaft In Case Front Section

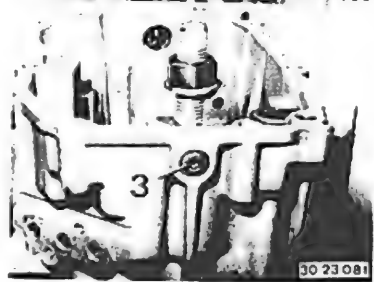
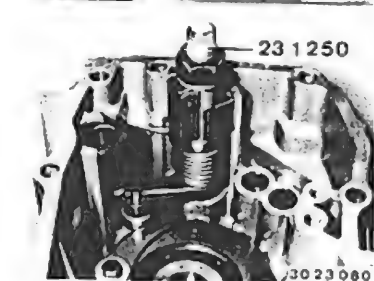
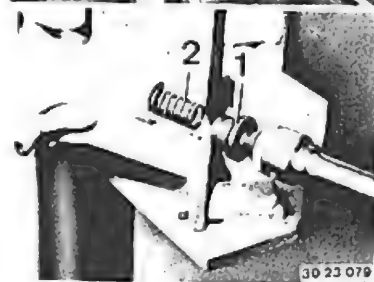
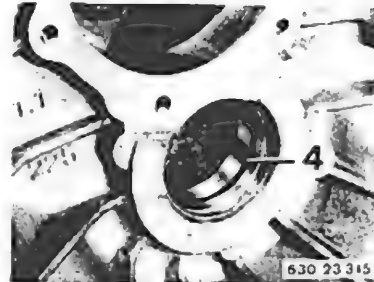
Input Shaft:
Drive out grooved ball bearing with Special Tools 23 1 480 and 00 5 500.

Important!
Collar is on clutch end.

Layshaft:
Loosen circlip (1) with a single knock from Special Tool 23 1 270 used in conjunction with Special Tool 00 5 500.

Lift out circlip (2).
Remove spacer (3).

Drive out bearing shell toward the inside with Special Tools 23 1 270 and 00 5 500.



Version with O-ring:
Lift out O-ring (4) with a feeler gage blade.

Installation:
Replace and insert new O-ring coated with engine oil in groove prior to installation of the bearing shell.

B) Output Shaft, Layshaft In Case Rear Section

Output Shaft:
Unscrew bolt (1).

Caution!
Spring pressure.

Remove spring (2).

Installation:
Install bolt with a bolt cement**.

Install Special Tool 23 1 250 for removal of the selector arm.

Remove socket head screw (3).

Installation:
Install screw with a bolt cement**. Tightening torque*.

- * See Specifications
- ** Source of Supply: HWB

23-78

Remove selector arm from above.

Important!
Roller.

Installation:
Install spring (2).
Insert selector arm with Special Tool 23 1 250.
Swing out selector arm with the roller over locking lever (4).

Move end of spring (3) over the raised point into installed position. Press down on the selector arm in this position (do not knock down). Install the socket head screw with a bolt cement** and tighten with correct torque* before removing the special tool.

Unscrew bolt.
Take off locking lever (4) and spacer (5).
Remove bearing holder (6).

Installation:
Install bolt with a large washer.

- * See Specifications
- ** Source of Supply: HWB

Installation:
Check the installed position of locking lever (4) and thrust pin (7).

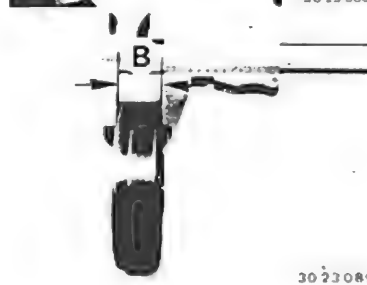
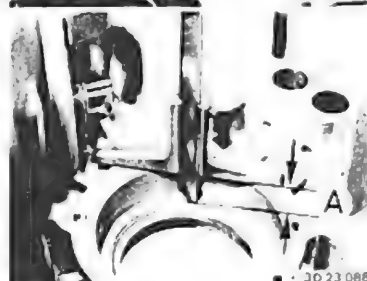
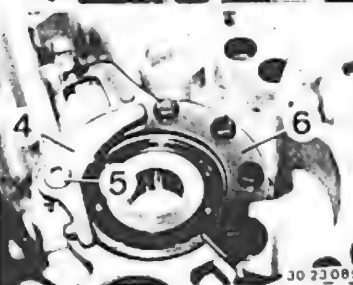
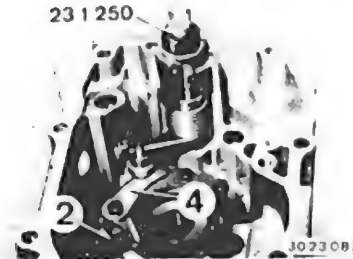
Lift out radial oil seal.
Drive out grooved ball bearing with Special Tools 23 1 120 and 00 5 500.

Important!
Shim X.

Determine thickness of shim X.
Measure distance (A).

Measure distance (B).

Example:
A = 17.5 mm (0.689")
B = 17.0 mm (0.669")
X = 0.5 mm (0.020") thick shim



23-79

Heat rear case section in area of the grooved ball bearing to about 80° C (175° F).
Install shim X.
Install grooved ball bearing.
Closed cage faces in.
If necessary, drive in against the stop with Special Tool 24 1 060.

Layshaft:
Apply the stronger end of Special Tool 23 1 280 in the bearing shell.
If applicable, remove the turning lock on the side of the drain plug.

Apply Special Tool 33 4 020.
Screw on Special Tool 23 1 300.
Pull out bearing shell.

Installation:
Install bearing shell that the slot in the bearing shell is aligned with the bead (turning lock) in the case.

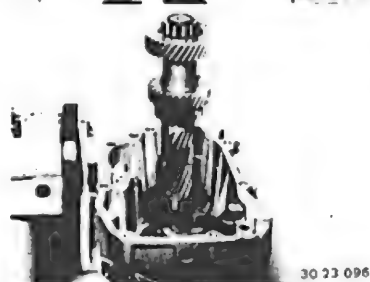
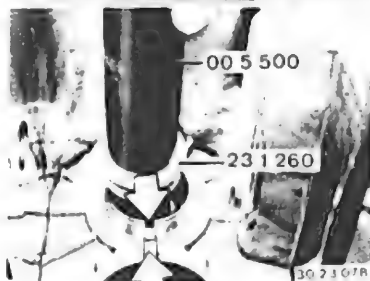
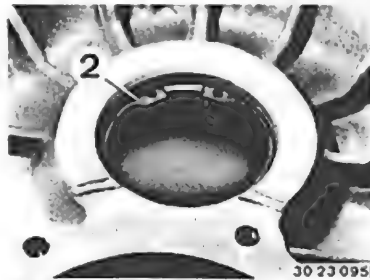
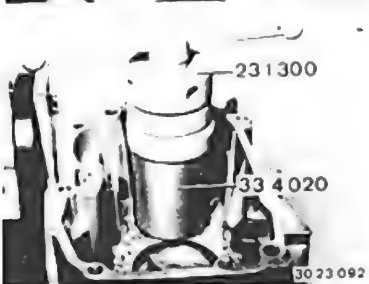
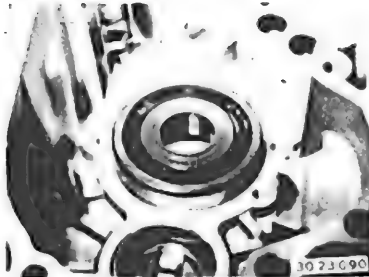
Drive in bearing shell with Special Tools 23 1 260 and 00 5 500.

Determining Axial Play of Layshaft:
Install circlip (2).

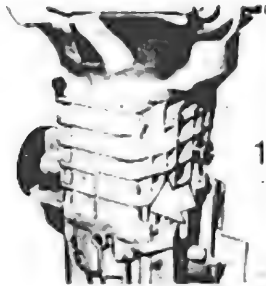
Install old shims.
Drive in bearing shell to fit tight in the front case section with Special Tools 23 1 260 and 00 5 500.

Important!
The oil groove must be aligned with the groove in the case.

Place layshaft with roller bearings in the rear case section.



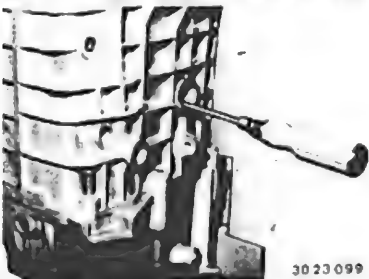
23-80



Mount front case section and secure with two bolts opposite each other. Center front case section slightly with dowel pins. Unscrew oil filler plug (1).



Mount holder with dial gage. Dial gage must bear on tooth of the layshaft.



Check axial play of the layshaft through the bore for the oil filler plug. Axial play: 0.13 to 0.23 mm (0.005 to 0.009"). Correct when necessary by removing the bearing shell and replacing the shim with a thicker one.



Install gear wheel set. Determine thickness of shim for the input shaft. Install old shim and circlip. Reduce play to 0 ... 0.09 mm (0 to 0.0035"). Determine thickness of shim for the guide sleeve – see 23 11 623.

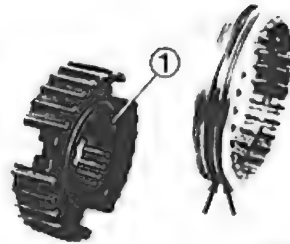
23-81

23 23 505 DISASSEMBLING AND ASSEMBLING COMPLETE SYNCHRONIZATION - Output Shaft Removed -

Disassemble output shaft - see 23 21 554.

Note:
Only use molybdenum coated synchromesh rings for repairs.
Check distance* between synchromesh ring and clutch body.
Measure in area of stops.

Note:
Twist and press down on synchromesh ring while measuring.
Synchromesh rings should bear on the entire surface uniformly.



30 23 144

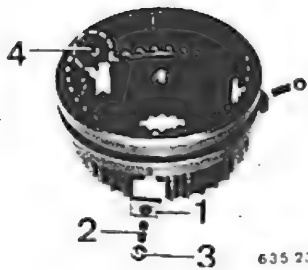
Version with Two Grooves:
Grooves of operating sleeve must be on end with the wide collar (1).



30 23 104

Install all springs, thrust pieces and balls.

Important!
Shouldered end of thrust pieces faces the operating sleeve.
Insert guide sleeve in operating sleeve to half its length.
Press in balls far enough, until the guide sleeve can be pressed into the operating sleeve.



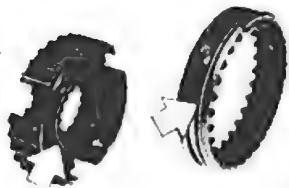
635 23 137

Disassemble synchronizer.
Thrust piece (1), spring (2) and ball (3).

Installation:
Bores (4) or flattened teeth on the operating sleeve must be aligned with ball (3).

Important!
Only for 3rd/4th Gear Synchronization:

Version with One Groove:
Groove of operating sleeve must be on end with the narrow collar.



30 23 103

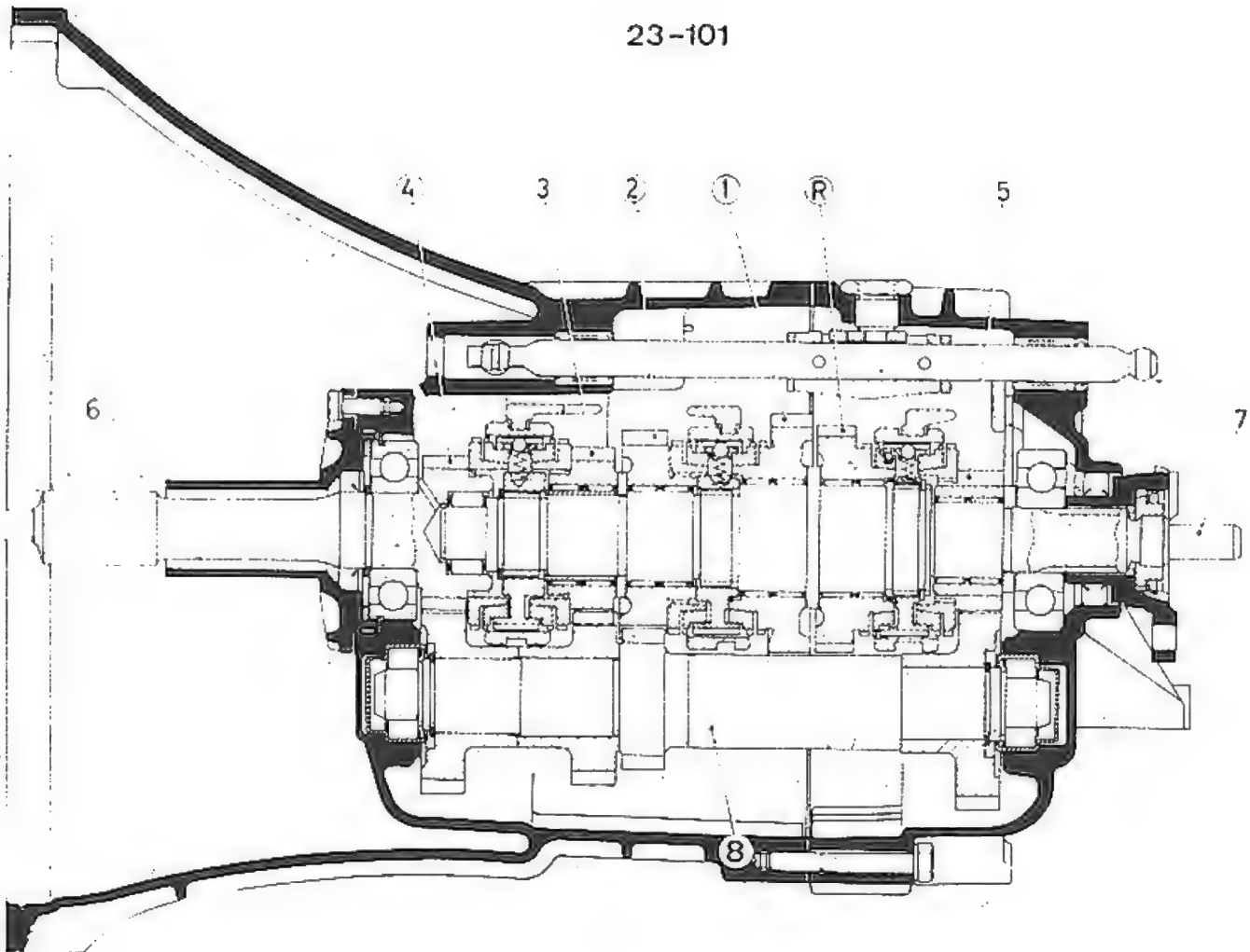
* See Specifications

Construction group 23 Manual transmission

ZF – S5 – 16 Manual transmission (overdrive)

	Drawing – transmission	23- 101
	Drawing – shift components	23- 102
23 11 014	Transmission case front section – remove and install/seal	23- 103
624	Guide sleeve for clutch release – remove and install	23- 106
23 12 504	Radial oil seal for input shaft – replace	23- 108
23 21 504	Input and output shaft assembly – remove and install	23- 109
555	Output shaft – replace	23- 113
704	Bearings of all transmission shafts – replace	23- 118
23 23 506	Synchronization – disassemble and assemble	23- 120

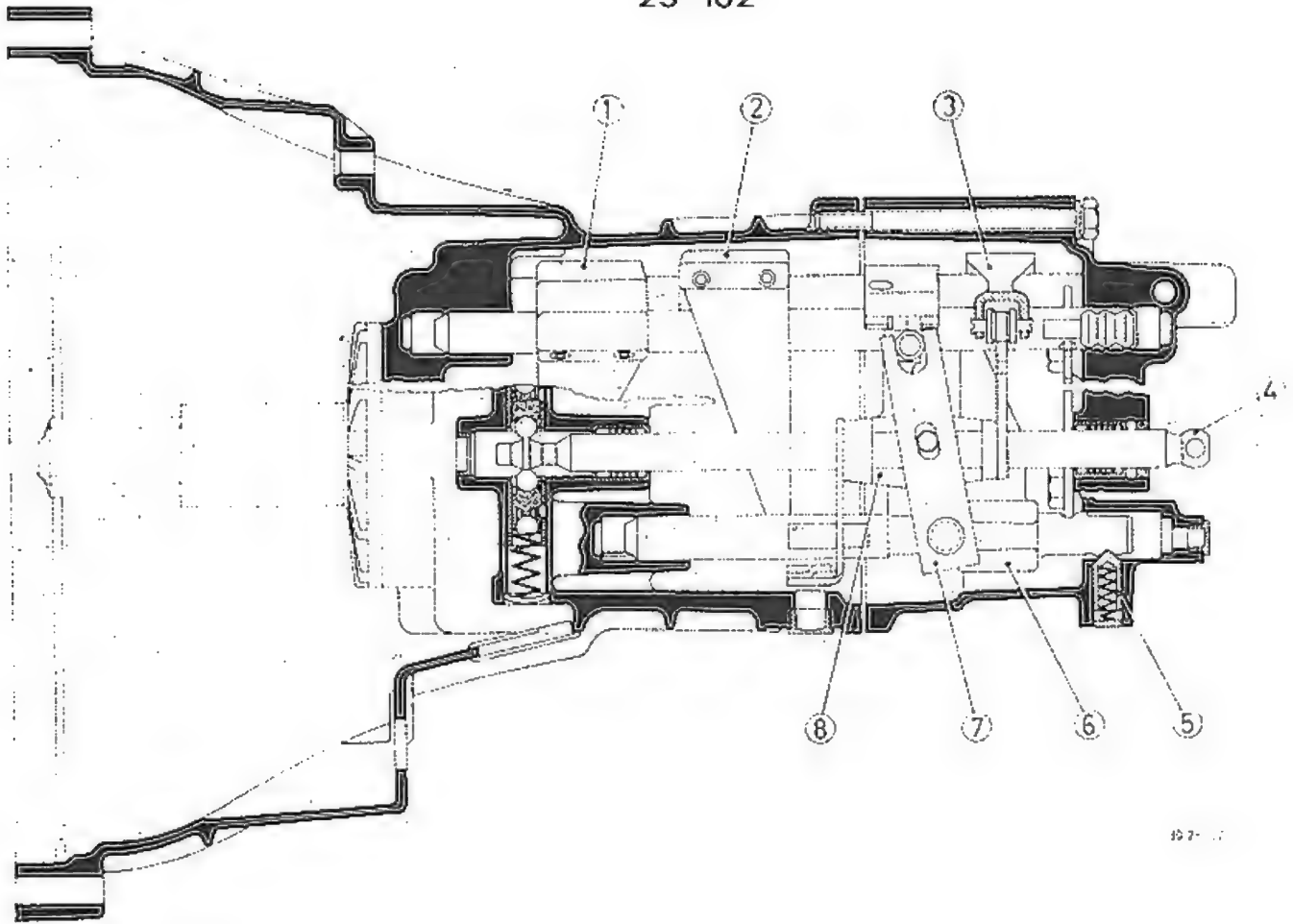
23-101



ASSEMBLY DRAWING OF ZF - S5 - 16 FIVE SPEED OVERDRIVE MANUAL TRANSMISSION

- | | | |
|---------------|----------------|----------------|
| 1 First gear | 4 Fourth gear | 6 Input shaft |
| 2 Second gear | 5 Fifth gear | 7 Output shaft |
| 3 Third gear | R Reverse gear | 8 Layshaft |

23-102



10-7-11

ASSEMBLY DRAWING OF SHIFT PARTS FOR ZF - SS - 16 FIVE SPEED OVERDRIVE MANUAL TRANSMISSION

- 1 Selector fork --- 3rd/4th gear
- 2 Selector fork --- 1st/2nd gear
- 3 Leaf spring
- 4 Selector shaft

- 5 Stop pin
- 6 Selector fork --- reverse/5th gear
- 7 Operating lever
- 8 Selector arm

23-103

23 11 014 REMOVING AND INSTALLING/ SEALING TRANSMISSION CASE FRONT SECTION

Remove transmission — see pertinent model repair manual microfiche since 1985 models — 23 00 022.
Mount Special Tool 23 0 090 on Special Tool 00 1 490.
Mount transmission on special tool assembly.
Drain oil.

Remove guide sleeve 23 11 624.
Lift out circlip (1).

Unscrew backup light switch.
Drive back cylindrical pins.
Unscrew bolts.

Pull off case front section with Special Tools 23 1 460 and 33 1 301.

Pull off case front section.

Installation
Replace gasket.
Remove old gasket with adhesive remover**

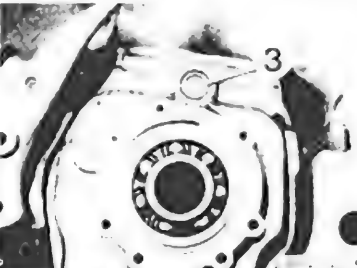
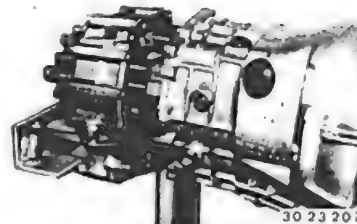
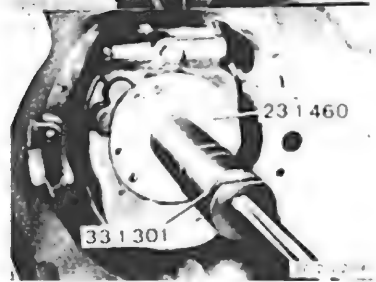
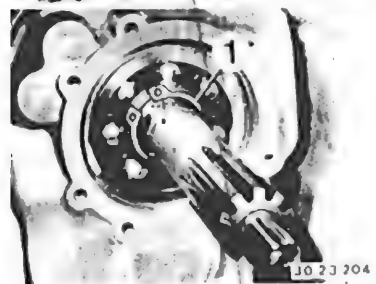
Important!
Installation
Magnet (2) in case rear section.
Clean magnet.

Drive out end cap (3).

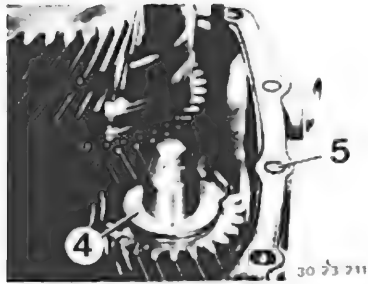
Installation
Replace end cap and insert with sealing compound**.

Drive out grooved ball bearing in direction of clutch housing.

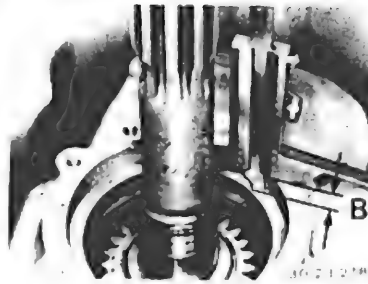
** Source: HWB



23-104



Hold thrust washer (4) on the reverse gear shaft with grease that the angle faces bore (5) in the rear case section. New version without angle. Install gasket with grease.

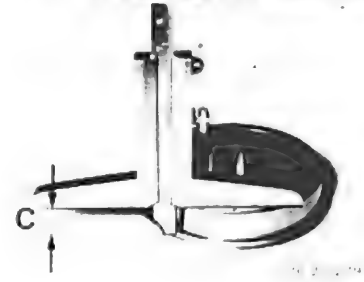


Measure distance (B) from sealing surface of the guide sleeve to bearing surface of the snap ring.

Important!
If a shim is found between the snap ring and case while removing the bearing, it must be installed again for measuring.



Apply Special Tool 23 2 180 on the shift shaft.



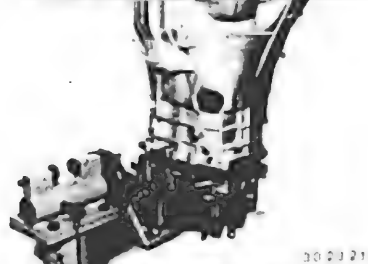
Measure distance (C) from bearing outer race to the snap ring.

Note:
Snap ring must be pressed firmly in the groove for measuring.

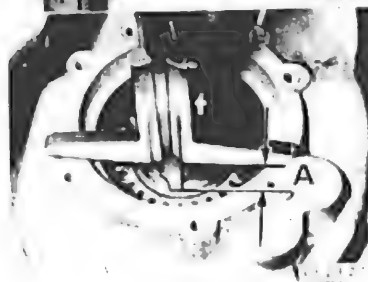
Example:

A	25.5 mm (1.004")
- B	10.3 mm (0.406")
	15.2 mm (0.598")
- C	14.0 mm (0.551")
	01.2 mm (0.047")

Axial play required: 1.1 to 1.3 mm (0.043 to 0.051").
Snap rings are available from Parts in different thicknesses for corrections.



Mount front case section and bolt on rear case section. Tightening torque*. Remove Special Tool 23 2 180. Install end cover for shift shaft.



The axial play of the input shaft has to be adjusted after replacing the case or bearings. Input shaft must bear on the synchromesh ring. Measure distance (A) from sealing surface of the guide sleeve to the input shaft.



Heat grooved ball bearing inner race and front case section in area of bearing to about 80° C (175° F) with a hot air blower and slide grooved ball bearing on the input shaft as far as possible.

* See Specifications

23-105

Press grooved ball bearing on to drive shaft or into front case section with Special Tool 23 1 007 used together with Special Tools 23 1 000 and 23 1 006.

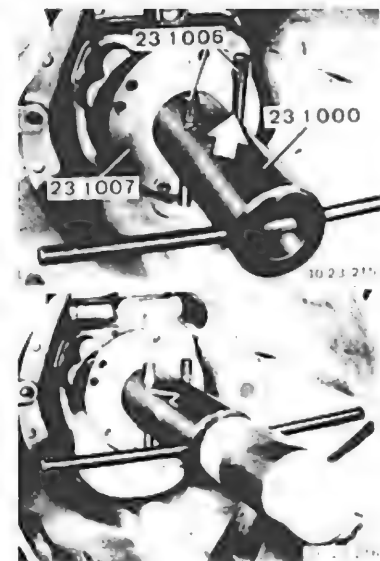
Important!

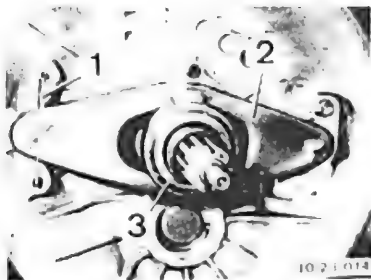
Apply Special Tools 23 1 006 in such a manner that the flat side faces the drive shaft.

Drive on grooved ball bearing further and further simultaneously with light knocks from a hammer.
Install circlip and reverse gear switch.

Note:

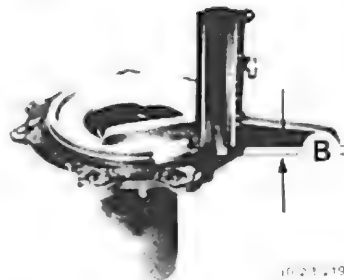
Coat operating pin of the reverse gear switch with oil.





**23 11 624 REMOVING AND INSTALLING
GUIDE SLEEVE FOR CLUTCH
RELEASE**
—TRANSMISSION REMOVED—

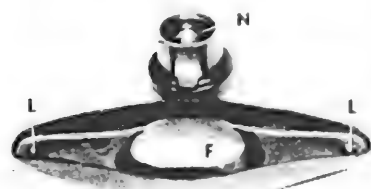
Lift out spring (1) and remove release lever (2) with thrust bearing (3).



Measure distance (B) from inside surface to sealing surface through opening in guide sleeve, with gasket installed.

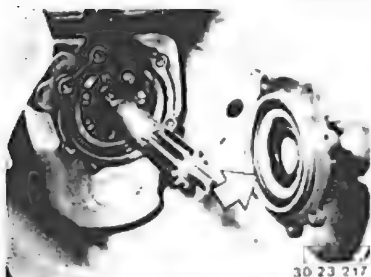
Example:

A	5.2 mm (0.205")
— B	3.2 mm (0.126")
	2.0 mm (0.079") spacer thickness



Installation

Pack lubricating groove N with Molykote Longterm 2.
Coat guides F and bearings L with Molykote Longterm 2.
Non-conformance could cause release bearing to seize on guide sleeve.



Detach guide sleeve.

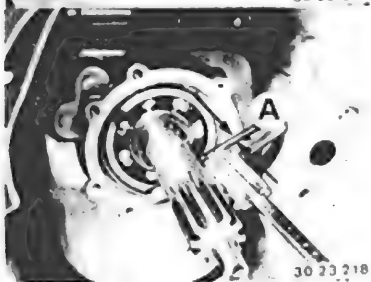
Important!

Spacer.

Installation

Replace gasket.

Remove old gasket with adhesive remover**.



Installation

Adjust play to 0 ... 0.09 mm (0 ... 0.0035").

Determine thickness of spacer.

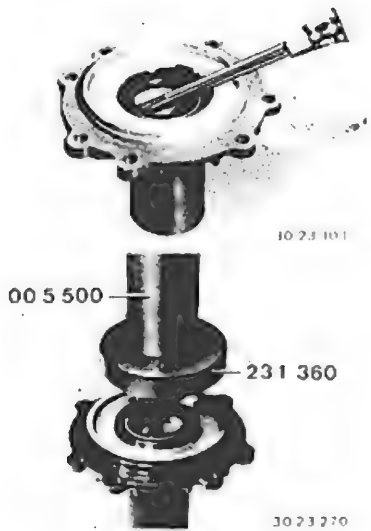
Measure distance (A) from sealing surface to bearing outer race.

** Source: HWB

23-108

23 12 504 REPLACING RADIAL OIL SEAL FOR INPUT SHAFT - Transmission Removed -

Remove guide sleeve - see 23 11 624.
Lift out radial oil seal.



Drive in new radial oil seal with Special
Tools 23 1 360 and 00 5 500.
Lubricate sealing lip with oil.

23-109

23 21 504 REMOVING AND INSTALLING INPUT AND OUTPUT SHAFT ASSEMBLY - Transmission Removed -

Remove front case section - see
23 11 014.
Lift out lockplate.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool
23 0 020.
Unscrew collar nut with Special Tool
23 1 210.

Pull off output flange with Special Tool
33 1 150.

Remove end plugs (1 ... 3).

Caution!
Spring force.

Installation:
Replace end plugs.

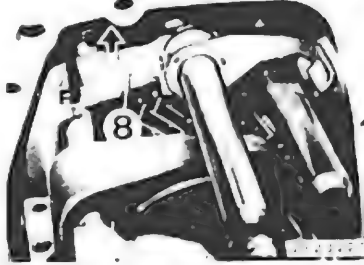
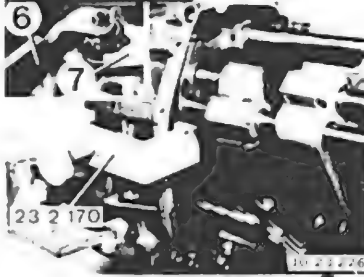
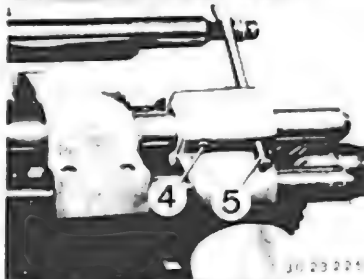
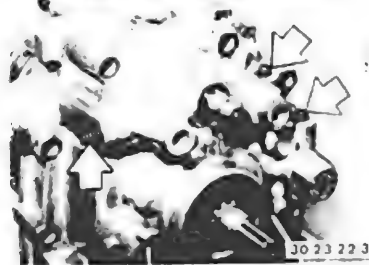
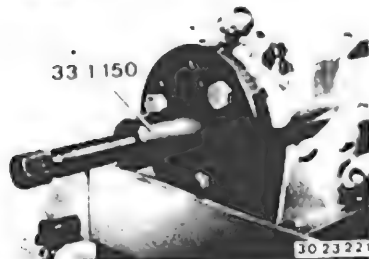
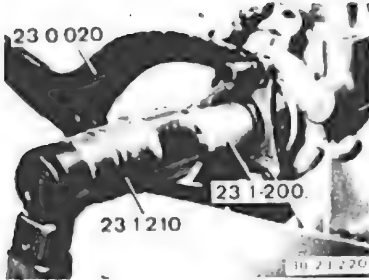
Remove three springs.

Pull out three catch pins with a circlip
pliers as far as possible.
Catch pins can only be pulled out
completely after removal of the lock.

Drive pins (4 and 5) out of the 3rd/4th
gear shift fork while counterholding.
New Version:
* pin.

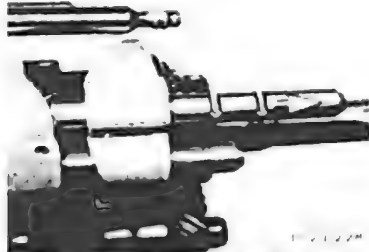
Push back leaf spring (6) for reverse
gear with Special Tool 23 2 170 far
enough, until shift finger (7) is
accessible.
It must be possible to turn the shift
shaft back and forth easily.

Swing shift finger (8) out of groove in
the shift rod.



23-110

Pull out 3rd/4th gear shift rod.

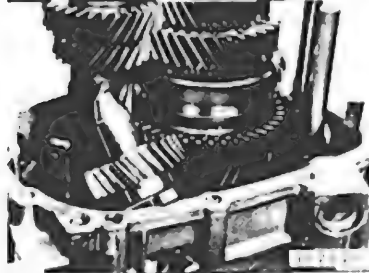


If applicable, remove lock in hexagon socket of bolt. Unscrew bolt (9).

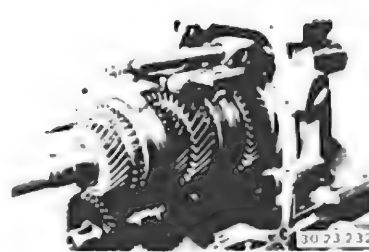
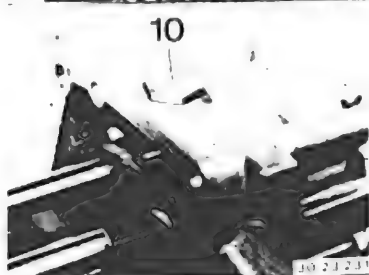
Important!
Seal between case and bolt.



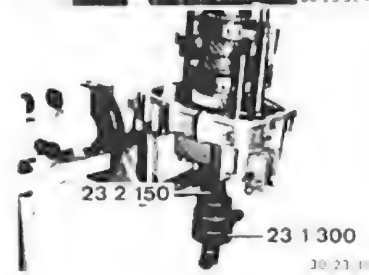
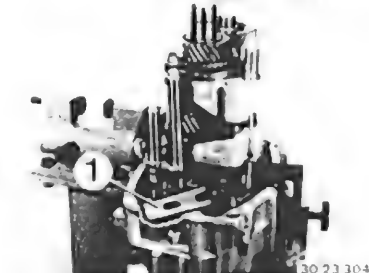
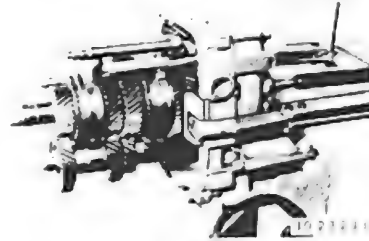
Remove reverse gear shaft, reverse gear wheel with needle bearing and thrust washer.



Remove bolt (10) for operating lever.



23 1 050



Important!
Engage reverse gear by sliding the operating sleeve forward before pressing out the gear wheel set.

Press input shaft, output shaft and layshaft out of rear case section with Special Tool 23 1 050.

Important!
Use a piece of wood, aluminum or something similar between claws and sealing surface to avoid damaging the sealing surface.

Important!
Make sure that shift rods and layshaft do not clamp while pressing out. Layshaft must not fall down in this step.

Installation:
Check condition of all bearings, replacing if necessary.

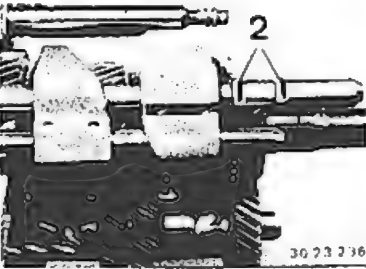
Installing:
Reverse gear is engaged. Install input and output shafts with shift rod for 1st/2nd gears, 3rd/4th gear shift fork, shift rod for 5th/reverse gears, shift shaft and layshaft in rear case section.

Important!
Check installed position of operating lever (1).

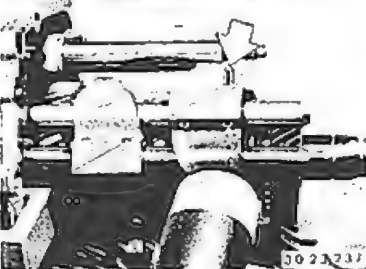
Pull input shaft, output shaft and layshaft into rear case section with Special Tools 23 1 300 and 23 2 150.

Important!
Make sure that shift rods, shift shaft and layshaft do not clamp while pulling in.

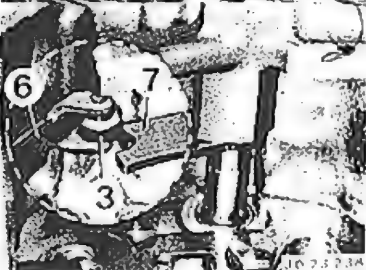
23-111



Take out reverse gear.
Slide in 3rd/4th gear shift rod with
openings (2) facing up.
New version: one opening.

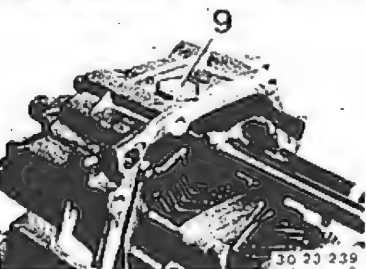


Drive in pins for 3rd/4th gear shift fork
while counterholding.
New version: 1 pin.



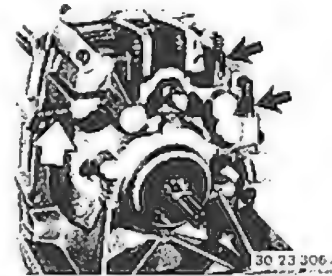
Remove Special Tool 23 2 170 for the
leaf spring.

Important!
Roller (3) on leaf spring (6) must
engage in the shift finger (7).

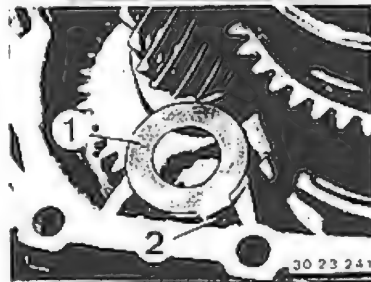


Install bolt (9) for operating lever.
Tip of bolt must engage in bore in
operating lever.
Tightening torque*.

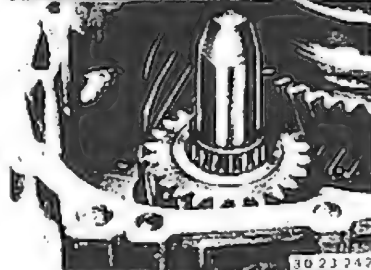
* See Specifications



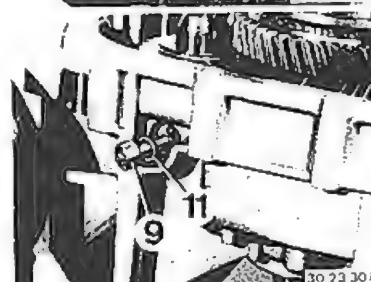
Insert three catch pins with springs in
case.
Install new end plugs approx. 0.5 mm
(0.020") below the case edge and
punch lock slightly.



Install thrust washer (1) with angle (2)
in upper opening on the case.
New version: without angle.



Install reverse gear wheel with long
collar facing case, two needle bearings
and shaft.

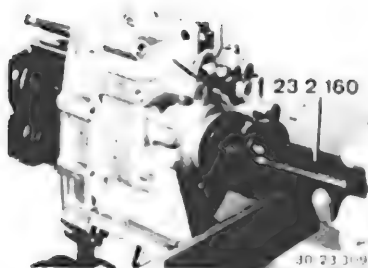


Install seal (11) on bolt.
Tighten bolt (9) to correct torque* and
install new locking cap.

* See Specifications

23 - 112

Drive in radial oil seal flush with
Special Tool 23 2 160.
Lubricate sealing lip with oil.



Insert or knock on output flange.
Install collar nut with a bolt cement**.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool
23 0 020.
Tighten collar nut with Special Tool
23 1 210.
Tightening torque*.



Install and lock lockplate in the groove.

- * See Specifications
- ** Source of Supply: HWB

23-113

23 21 555 REPLACING OUTPUT SHAFT - Output Shaft Removed -

Pull off input shaft (1), brass synchromesh ring (2) and needle bearing (3).

Note:
To avoid mixing up synchromesh rings while disassembling the output shaft, it is recommended to mark synchromesh rings for pertinent gear wheels.

Lift out circlip (4).

Installation:
Always replace the circlip.

Installation:
Remove guide sleeve play with circlip (4).
Circlips are available in different thicknesses from Parts.

Press 3rd gear wheel, guide and operating sleeves off of the output shaft with Special Tool 23 1 490. Take off needle bearing.

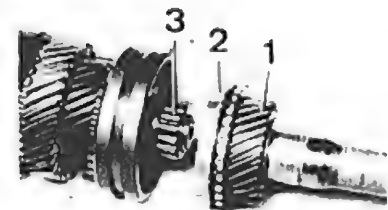
Press bearing sleeve, thrust washer and 2nd gear wheel off of the output shaft with Special Tool 23 1 490. Take off needle bearing and filtered metal synchromesh ring.

Important!
Circlip (5) must be removed before pressing off the 1st gear wheel.

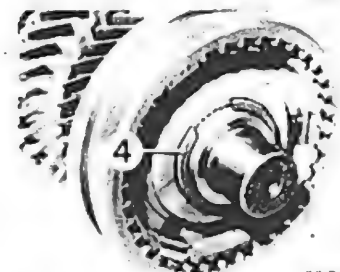
Installation:
Always replace the circlip.

Press 1st gear wheel, guide and operating sleeves off of the output shaft with Special Tool 23 1 490. Take off needle bearing.

Press thrust washer and 5th gear wheel off of the output shaft with Special Tool 23 1 490. Take off brass synchromesh ring and needle bearing.



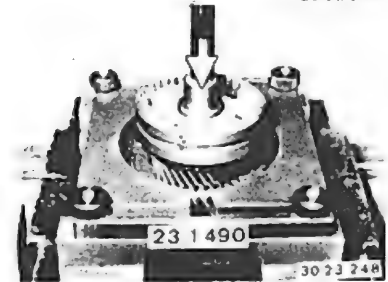
30 23 245



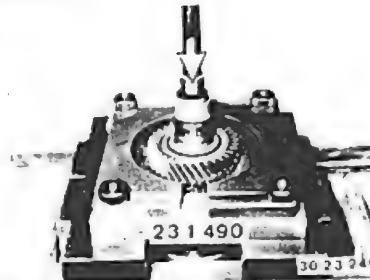
30 23 246



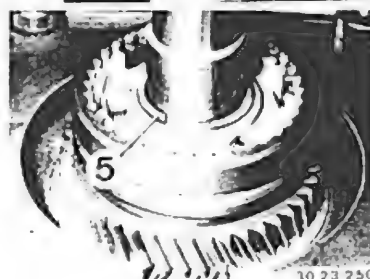
30 23 247



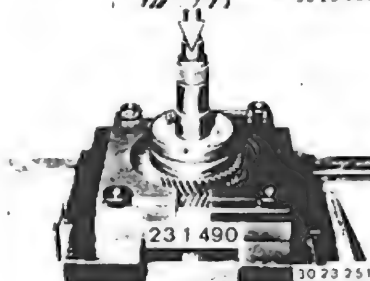
30 23 248



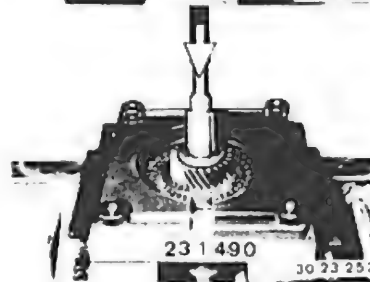
30 23 249



30 23 250

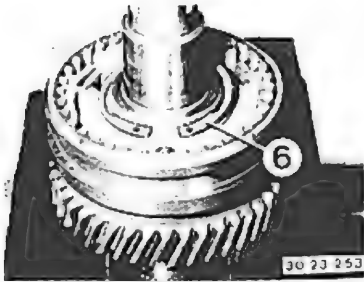


30 23 251



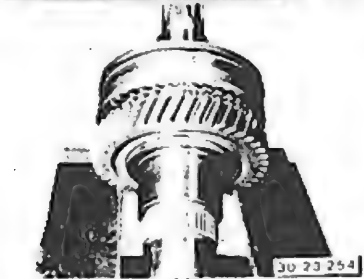
30 23 252

23 - 114

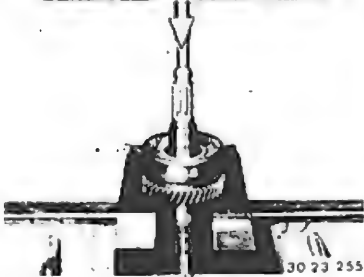


Important!
Circlip (6) must be removed before pressing off reverse gear.
Installation
Always replace circlip.

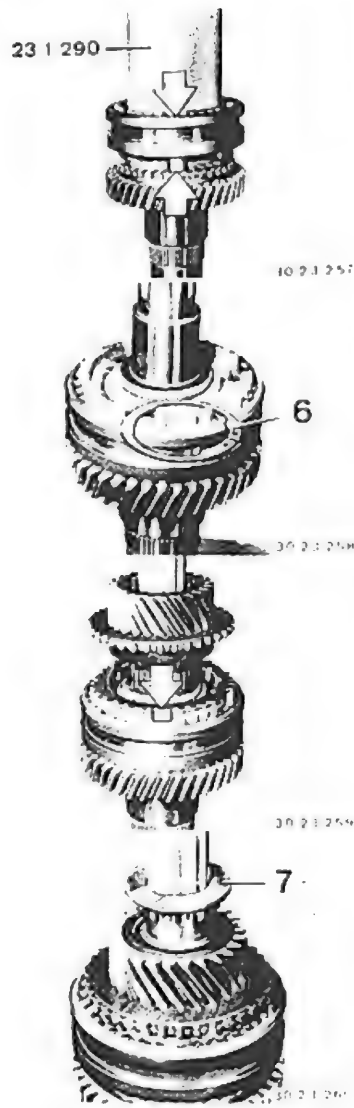
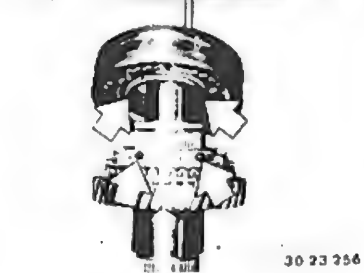
Install output shaft next to collar.



Press guide sleeve with sliding sleeve and reverse gear off of output shaft.
Remove needle bearing.
Only for version with reverse gear synchronization:
Brass synchronmesh ring with 6 balls.



Assembling:
Install needle bearing, reverse gear and brass synchronmesh ring with 6 grease held balls (only for version with reverse gear synchronization).
Install guide and sliding sleeve with narrow collar facing reverse gear.



Press on guide sleeve to fit tight with Special Tool 23 1 290.

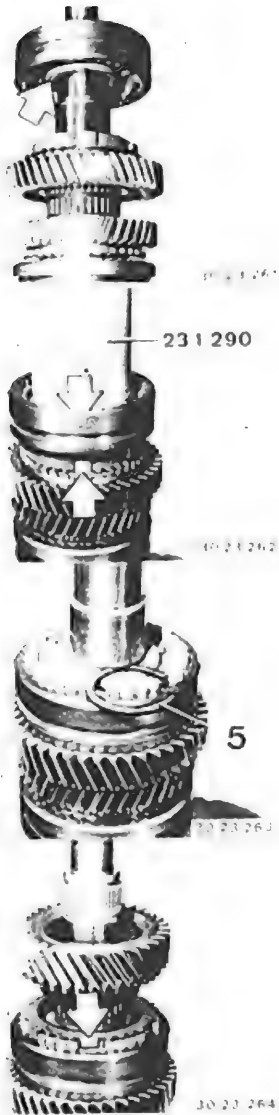
Important!
Make sure that short tabs of synchronmesh ring are aligned with groove in pressure pieces when pressing on guide sleeve.

Move sliding sleeve in reverse gear direction.
Adjust guide sleeve with circlip (6) to take up all play.
Circlips are available from Parts in different thicknesses.
Install circlip (6).

Install brass synchronmesh ring with short tabs of synchronmesh ring in groove of pressure pieces.
Install needle bearing and 5th gear.

Heat thrust washer (7) to approx. 80°C (175°F) with a hot air blower and install on output shaft.

23-115



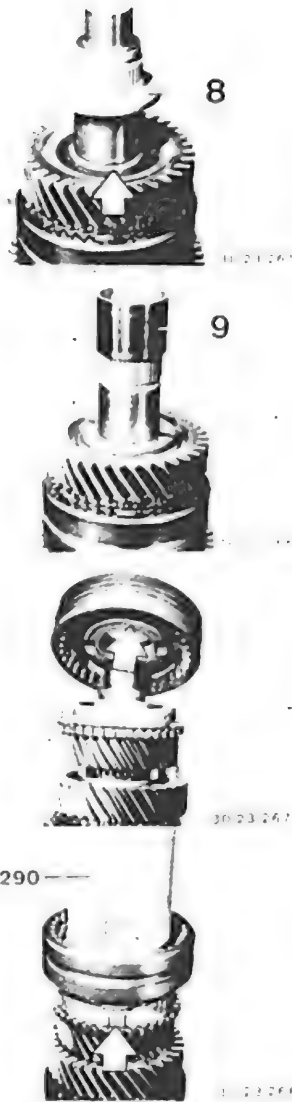
Install needle bearing, 1st gear wheel and sintered metal synchromesh ring. Install guide and operating sleeves with the narrow collar facing the 1st gear wheel.

Press on guide sleeve to fit tight with Special Tool 23 1 290.

Important!
Make sure that short tabs of synchromesh ring are aligned with groove in thrust pieces while pressing on.

Shift operating sleeve in direction of the 1st gear wheel.
Adjust guide sleeve to be without play. Circlips are available from Parts in different thicknesses.
Install circlip (5).

Install sintered metal synchromesh ring with its short tabs in the groove of thrust pieces.
Install needle bearing and 2nd gear wheel.



Important!
Collar for the thrust washer on the output shaft must protrude slightly. If necessary, check circlip (5) for correct seating.
Heat thrust washer (8) to about 80° C (175° F) with a hot air blower and install on the output shaft.

Heat bearing sleeve (9) to about 80° C (175° F) with a hot air blower and install on the output shaft.

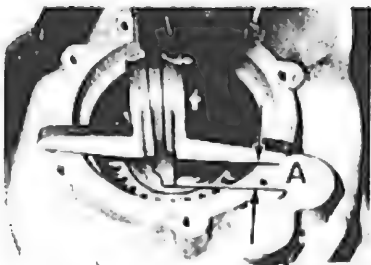
Install needle bearing, 3rd gear wheel and brass synchromesh ring. Install guide and operating sleeves with the long collar facing the 3rd gear wheel.

Note:
Version with Identification Groove:
Groove faces the 3rd gear wheel.

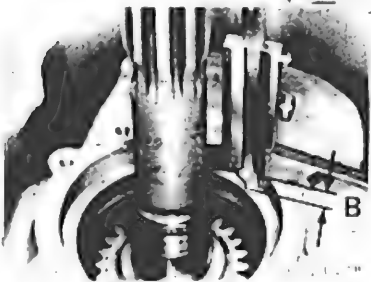
Press on guide sleeve to fit tight with Special Tool 23 1 290.

Important!
Make sure that short tabs on synchromesh ring are aligned with groove in thrust pieces while pressing on.

Install circlip.



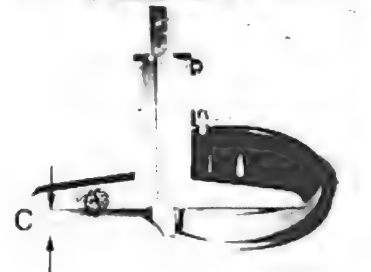
Adjust axial play of input shaft.
Output shaft and case front section installed.
Input shaft must rest on synchromesh ring.
Measure distance (A) from guide sleeve sealing surface to input shaft.



Measure distance (B) from guide sleeve sealing surface to circlip bearing surface.

Important!

If a spacer had been found between the circlip and case while removing the bearing, it must be installed again for measuring.



Measure distance (C) from bearing outer race to circlip.

Note

Circlip must be pressed tight in groove for measuring.

Example:

A	25.5 mm (1.003'')
- B	10.3 mm (0.405'')
	15.2 mm (0.598'')
- C	14.0 mm (0.551'')
	1.2 mm (0.047'')

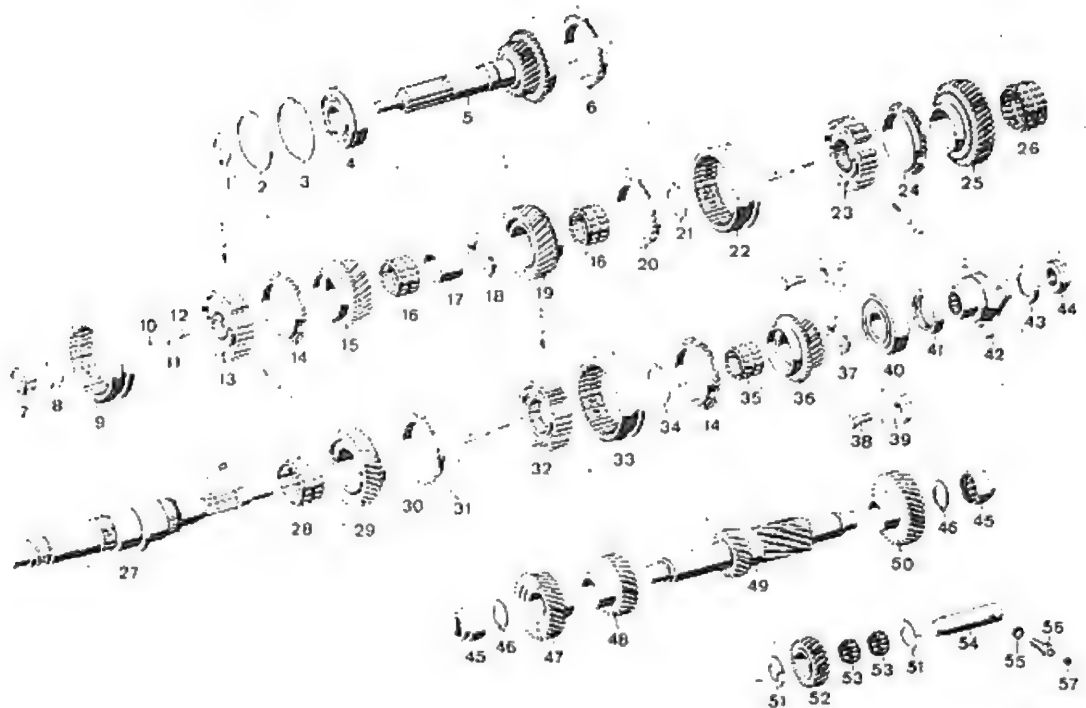
Axial play required: 1.1 to 1.3 mm (0.043 to 0.051'').

Circlips are available from Parts in different thicknesses for making corrections.

Install grooved ball bearing - see 23 11 014.

23-117

DRAWING OF GEAR SET AND BEARINGS



- 1 Circlip
- 2 Spacer
- 3 Circlip
- 4 Grooved ball bearing
- 5 Input shaft
- 6 Synchronesh ring
- 7 Roller bearing
- 8 Circlip
- 9 Sliding sleeve
- 10 Pressure piece
- 11 Ball
- 12 Spring
- 13 Guide sleeve
- 14 Synchronesh ring
- 15 3rd gear
- 16 Needle bearing
- 17 Bearing sleeve
- 18 Thrust washer
- 19 2nd gear
- 20 Synchronesh ring
- 21 Circlip
- 22 Sliding sleeve
- 23 Guide sleeve
- 24 Synchronesh ring
- 25 1st gear
- 26 Needle bearing
- 27 Output shaft
- 28 Needle bearing
- 29 Reverse gear
- 30 Synchronesh ring
- 31 Ball (six)
- 32 Guide sleeve
- 33 Sliding sleeve
- 34 Circlip
- 35 Needle bearing
- 36 5th gear
- 37 Thrust washer
- 38 Bolt
- 39 Clamp
- 40 Grooved ball bearing
- 41 Radial oil seal
- 42 Output flange
- 43 Lockplate
- 44 Collar nut
- 45 Roller bearing
- 46 Circlip
- 47 4th gear
- 48 3rd gear
- 49 Layshaft
- 50 5th gear
- 51 Thrust washer
- 52 Reverse gear
- 53 Needle bearing
- 54 Shaft
- 55 Seal
- 56 Bolt
- 57 Bolt lock

30 23 278

23-118

23 21 704 REPLACING BEARINGS OF ALL TRANSMISSION SHAFTS -TRANSMISSION REMOVED-

Remove transmission case front section
23 11 014.

A) Input Shaft, Layshaft in Case Front
Section:

Input Shaft:
Drive out grooved ball bearing in direction
of clutch housing.

Adjust axial play of input shaft.
Case front section attached.
Input shaft must be on synchromesh ring.
Measure distance (A) from guide sleeve
sealing surface to input shaft.

Measure distance (B) from guide sleeve
sealing surface to circlip bearing surface.

Measure distance (C) from bearing outer race
to circlip.

Note

Circlip must be pressed tight in groove for
measuring.

Example:

A	25.3 mm (0.996")
- B	10.1 mm (0.398")
	15.2 mm (0.598")
- C	14.0 mm (0.551")
	1.2 mm (0.047")

Axial play required: 1.1 to 1.3 mm (0.043 to
0.051").

Different size circlips are available from Parts.

Layshaft:
Destroy roller cage of bearing.
Remove cage with rollers.

Pull out bearing outer race (1) with Special
Tools 00 8 550 (without supports) and
33 1 356.

Heat case front section in area of roller bearing
to about 80° C (175° F) with a hot air blower.
Drive in roller bearing with Special Tool
23 2 220.

B) Output Shaft, Layshaft in Case Rear Section:
Remove input and output shaft assembly
23 21 504.

Output Shaft:
Remove Special Tool 23 2 170.
Pull off leaf spring (1).

23-119

Unscrew bolts.
Take off clamps (2 and 3).

Installation:
Install clamps with curved surface
facing the bearing outer race.
Tightening torque*.

Lift out radial oil seal.
Drive out grooved ball bearing with
Special Tools 23 1 120 and 00 5 500.

Heat rear case section in area of the
grooved ball bearing to about 80° C
(175° F) with a hot air blower.
Install grooved ball bearing.
If applicable, drive in bearing to fit
tight with Special Tool 24 1 100.

Drive in radial oil seal with Special
Tool 23 2 160.
Lubricate sealing lip with oil.

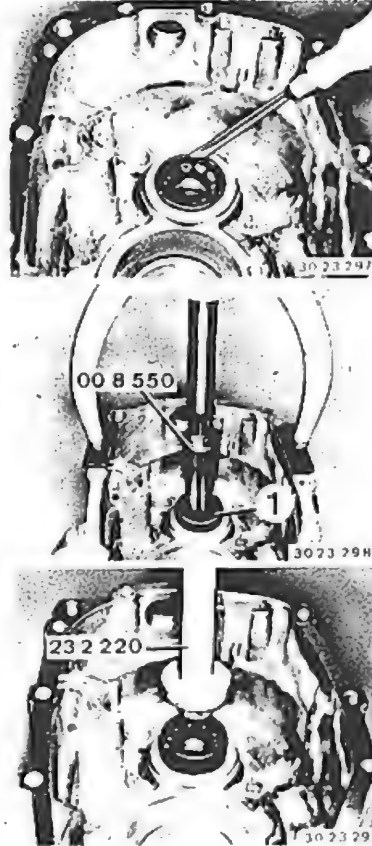
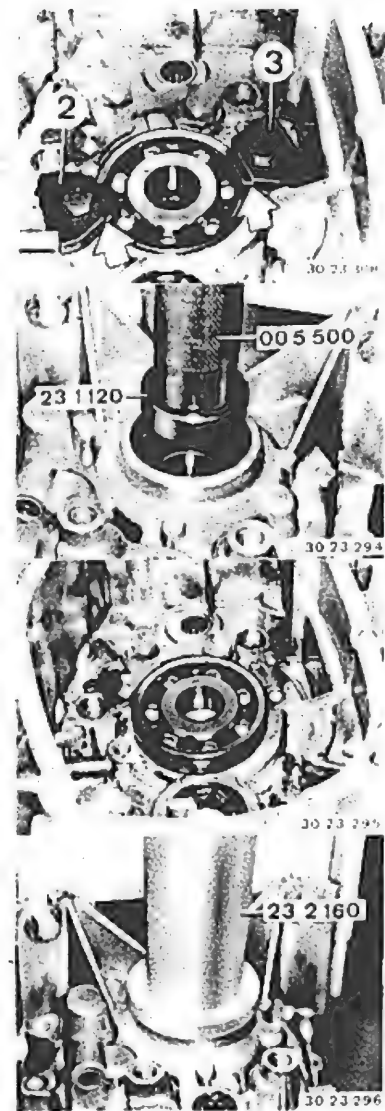
* See Specifications

Layshaft:
Destroy roller cage of the bearing.
Remove cage with rollers.

Pull out bearing outer race (1) with
Special Tools 00 8 550 and a support.

Important!
Use a piece of flat iron or something
stippler between the support and
sealing surface, to avoid damaging the
sealing surface.

Heat rear case section in area of the
roller bearing to about 80° C (175° F)
with a hot air blower.
Drive in roller bearing with Special
Tool 23 2 220.



23-120

23 23 506 DISASSEMBLING AND ASSEMBLING COMPLETE SYNCHRONIZATION - Output Shaft Removed -

Disassemble output shaft - see 23 21 555.
Check distance* between synchromesh ring and clutch body.
Measure in area of stop.

Note:
Twist and press down synchromesh ring for measuring.
Synchromesh rings should bear uniformly on the entire surface.

Disassembling Synchronization:
Press operating sleeve off of guide sleeve.
Spring (1), thrust piece (2) and ball (3).

Installation:
Flat teeth of operating sleeve must align with the thrust pieces.

Install all springs, thrust pieces and balls.

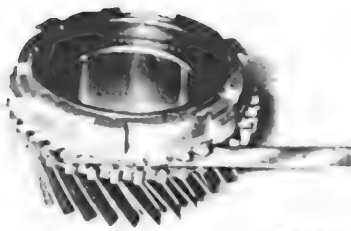
Important!
Shouldered end of thrust pieces faces the collar.
Press ball into the operating sleeve one after the other.



1st/2nd Gear Synchronization:
Check installed position of operating sleeve.
Wide surface end (4) of operating sleeve faces thicker collar (5).



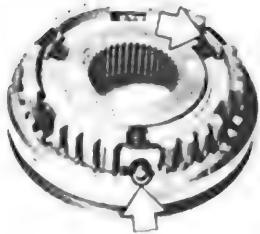
5th/Reverse Gear Synchronization:
Check installed position of operating sleeve.
Wide surface end (6) of operating sleeve faces narrow collar (7).



10 23 2 11



30 23 2 12



30 23 2 13

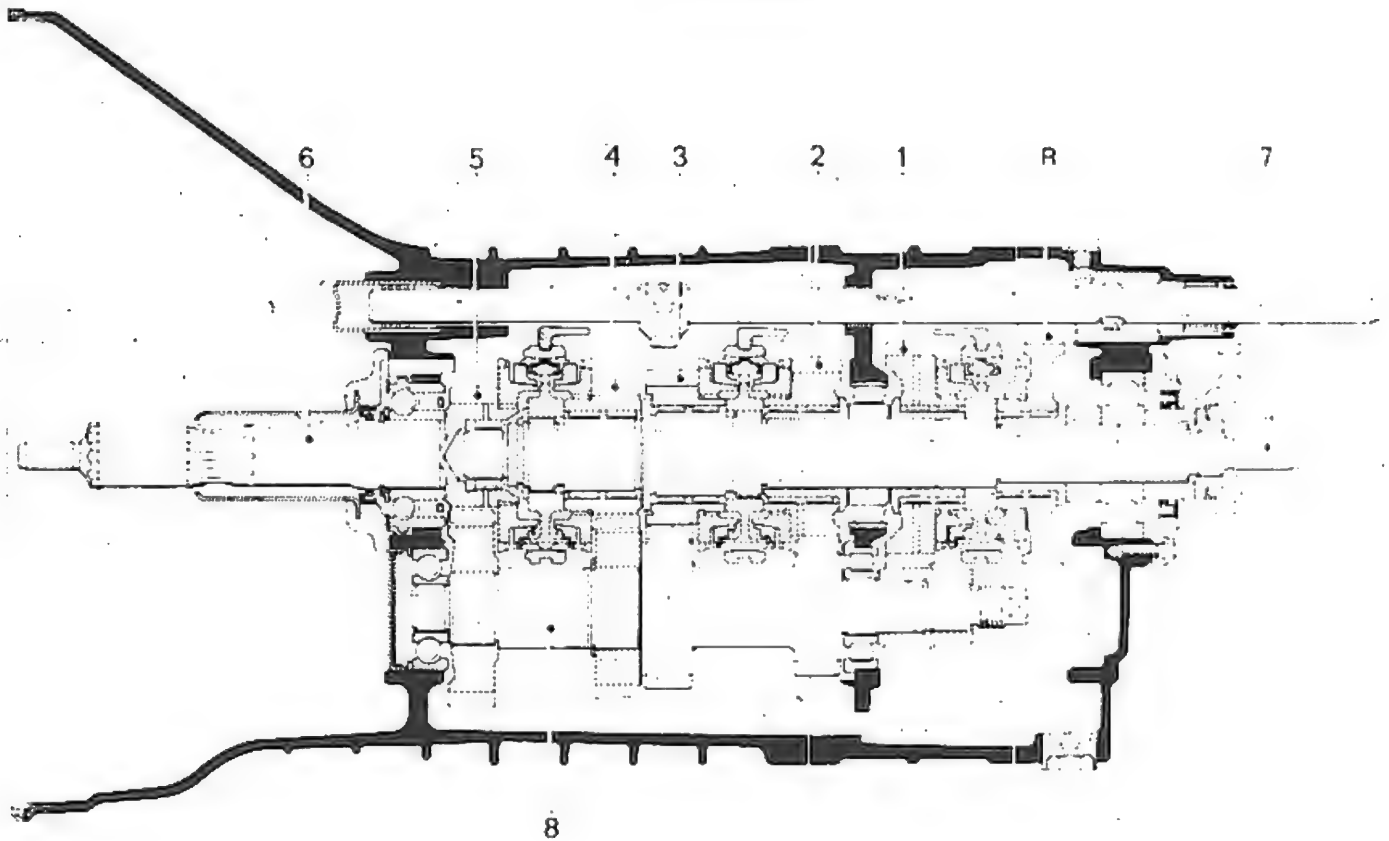
* See Specifications

Construction group 23 Manual transmission

Getrag 245 Five speed manual transmission (sport)

	Transmission – assembly drawing	23-	140
	Shift mechanism – assembly drawing	23-	141
23 11 005	Transmission case front section – remove and install / seal	23-	142
040	Transmission case rear section – remove and install / seal	23-	143
622	Clutch release guide sleeve – remove and install / replace	23-	147
23 12 502	Radial oil seal for input shaft – replace	23-	148
23 21 501	Input and output shaft assembly – remove and install	23-	149
552	Output shaft – replace	23-	151
703	Bearings of all transmission shafts – replace	23-	154
23 23 004	Synchronisation – disassemble and assemble	23-	157

23-140

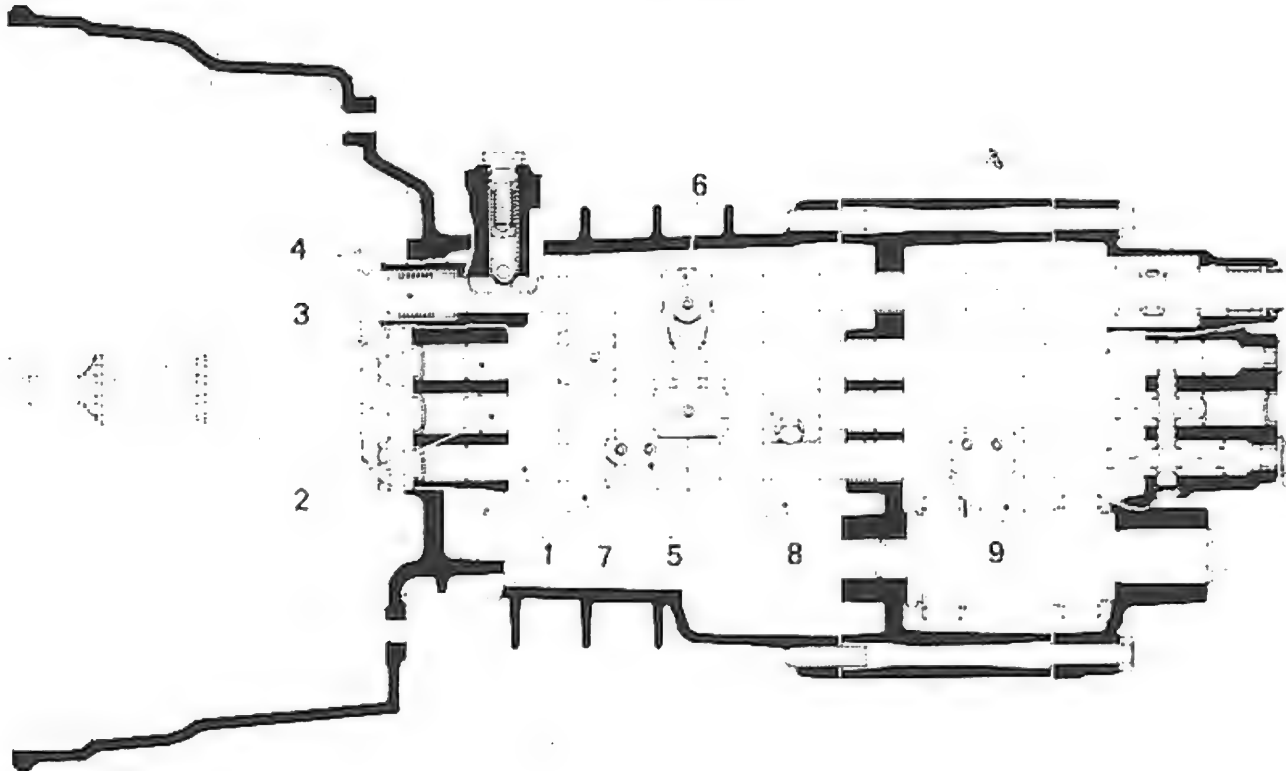


ASSEMBLY DRAWING OF GETRAG 245 FIVE SPEED SPORT MANUAL TRANSMISSION

- 1 First gear
- 2 Second gear
- 3 Third gear
- 4 Fourth gear

- 5 Fifth gear
- R Reverse gear
- 6 Input shaft
- 7 Output shaft
- 8 Layshaft

23-141



ASSEMBLY DRAWING OF SHIFT PARTS FOR 245 FIVE SPEED SPORT MANUAL TRANSMISSION

- 1 Selector rod, 1st/reverse gear
- 2 Selector rod, 2nd/3rd gear
- 3 Selector rod, 4th/5th gear
- 4 Selector shaft
- 5 Dog

- 6 Selector arm
- 7 Selector fork 4th/5th gear
- 8 Selector fork 2nd/3rd gear
- 9 Selector fork 1st/rev. gear

23-142

23 11 005 · REMOVING AND INSTALLING/ SEALING TRANSMISSION CASE FRONT SECTION

Remove transmission — see pertinent model repair manual microfiche since 1985 models — 23 00 022.
Unscrew brackets for exhaust assembly and rubber mounts.

Mount Special Tool 23 0 060 on assembly stand 00 1 490.
Mount transmission on special tool.
Drain oil.

Remove guide sleeve 23 11 622.
Lift out circlip (1).
Remove spacer (2).
Installation:
Always replace circlip.

Pull out grooved ball bearing with Special Tool 23 2 020.

Lift out cover (3).
Remove spring (4) and lockpin (5).
Check installed position.

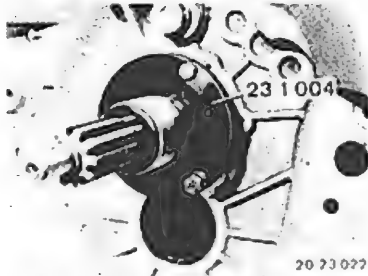
Drive out dowel pins.
Unscrew bolts on cover.
Loosen screw (6).

Pull off transmission case.
Installation:
Mount transmission case with a surface sealant**.
Sealing surface must be thoroughly cleaned and dried of oil.

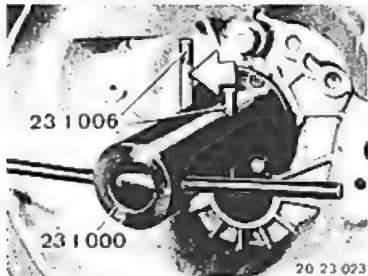
Install and bolt transmission case front section.
Tightening torque*.
Heat grooved ball bearing inner race to about 80° C (175° F) with a hot air blower and slide on to input shaft as far as possible.

* See Specifications
** Source: HWB

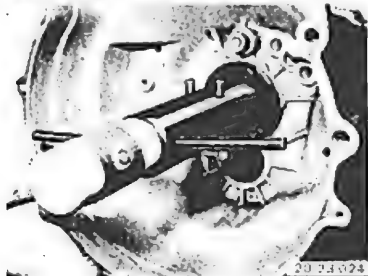
23-143



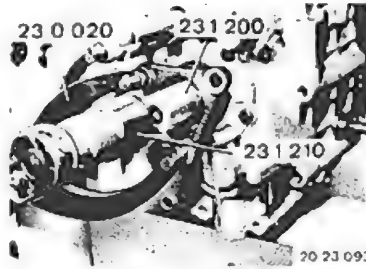
Mount Special Tool 23 1 004 on case with three 6 x 35 mm bolts, but not too tight.



Pull grooved ball bearing into case and on to input shaft with Special Tool 23 1 000 used in conjunction with Special Tools 23 1 006, which are machined flat on one side.
Important!
Insert Special Tools 23 1 006 that flat sides face the input shaft.

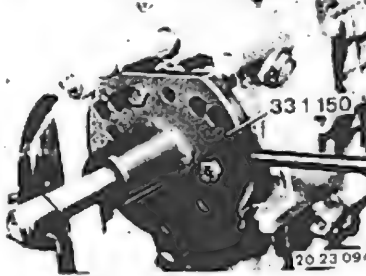


Drive in grooved ball bearing to fit tight by applying light knocks.
Install spacers and circlip.
Install lockpin.

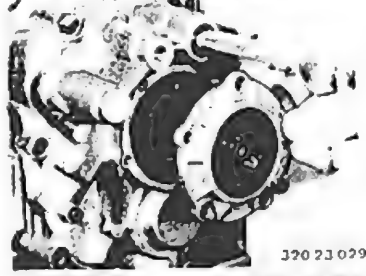


23 11 040 REMOVING AND INSTALLING/ SEALING TRANSMISSION CASE REAR SECTION

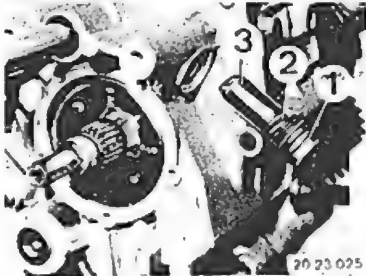
Remove transmission case front section 23 11 005.
Lift off lockplate.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew nut with Special Tool 23 1 210.
Installation:
Tightening torque*.
Install collar nut with bolt cement**.



Pull off output flange with Special Tool 33 1 150.



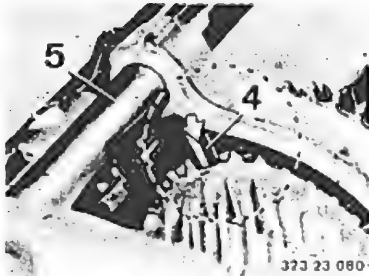
Take off cover.
Important!
Shims.
Installation
Replace gasket.



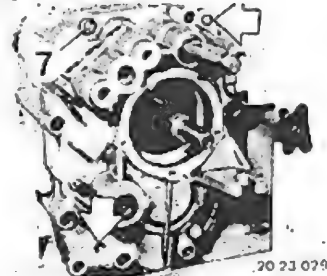
Unscrew plug (1).
Pull out-spring (2) and lockpin (3).
Installation:
Coat bearing surface of plug (1) with a surface sealant**.

* See Specifications
** Source: HWB

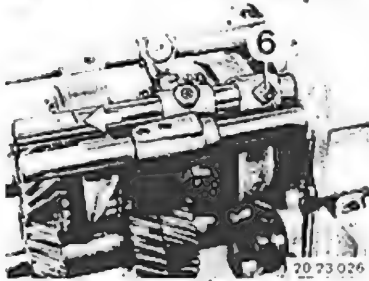
23-144



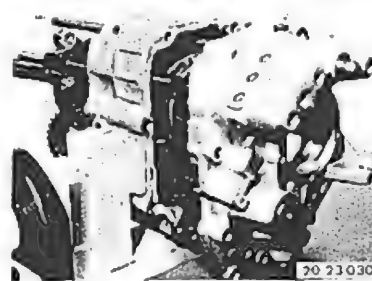
Engage 4th gear.
Turn input shaft until opening in 4th gear aligns with pin.
Drive out pin (4) downward in this position, until selector rod (5) can be pulled out (loose balls).
Important!
Drive pin between tooth flanks of operating sleeve.
Installation:
Replace pin.



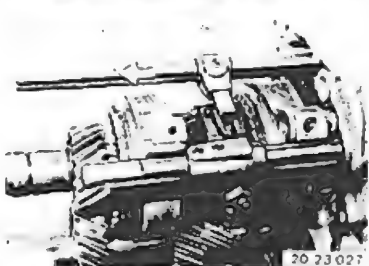
Drive out dowel pins.
Unscrew bolt (7).



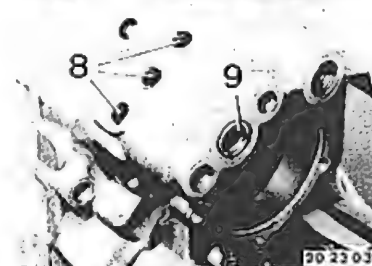
Remove lockwire.
Unscrew bolt (6).
Installation:
Lock bolt with wire.
Pull out 2nd/3rd gear selector rod.



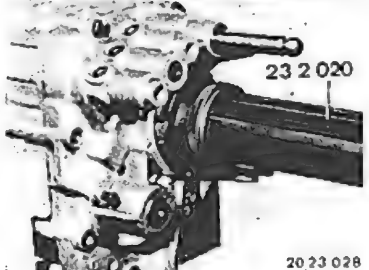
Pull off case rear section.
Important!
Spacer between double gear wheel and intermediate case.



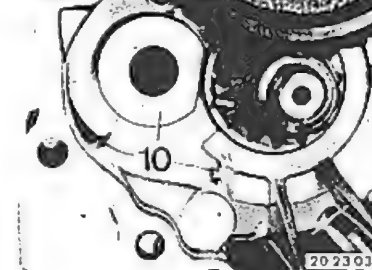
Pull out selector shaft forward as far as possible.



Unscrew backup light switch.
Remove plugs (8 and 9).
Installation:
Replace plugs.



Pull out grooved ball bearing with Special Tool 23 2 020 and the long spindle of Special Tool 23 2 060.



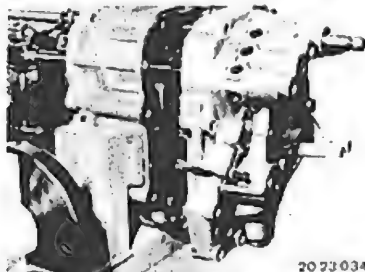
Hold spacer (10) in position with grease.
Check installed position.

23-145



Install needle bearing (1), spacer (2), needle bearing (3) and double gear wheel (4) on shaft.

20 23 033



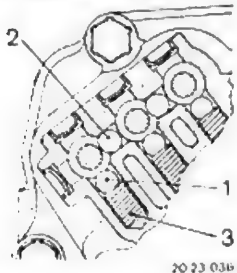
Coat sealing surface with surface sealant*. Sealing surface must be cleaned thoroughly and dried of oil. Slide on rear case section up to spring of locking balls.

20 23 034



Insert locking balls and press down. Slide on and bolt rear case section in this position.

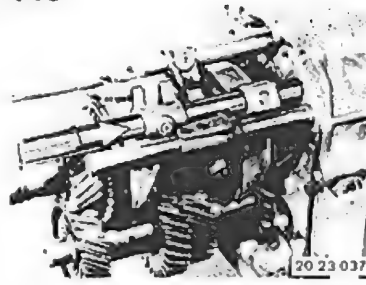
20 23 035



20 23 036

Arrangement of Detent and Locking Balls:
1 Locking ball
2 Detent ball
3 Spring

* Source: HWB



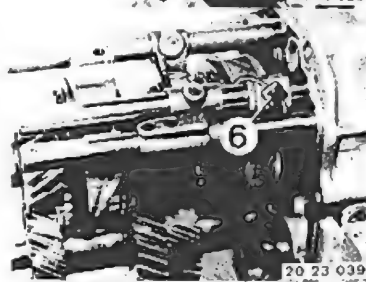
Slide 2nd/3rd gear selector rod into rear case section up to spring.

20 23 037



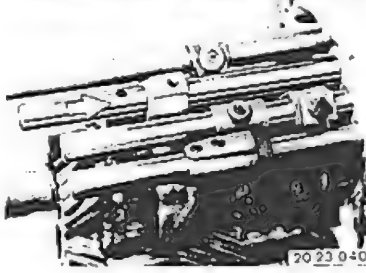
Insert locking balls. Insert detent balls and press down. In this position push selector rod through up to lock.

20 23 038



Mount 2nd/3rd gear selector fork with bolt (6) and lock bolt with wire.

20 23 039



Slide in 4th/5th gear selector rod up to spring on rear case section.

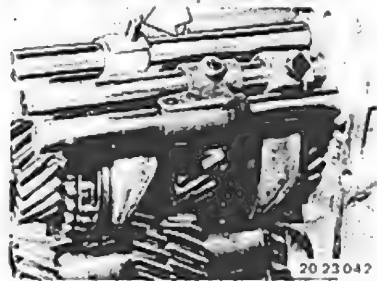
20 23 040

23-146



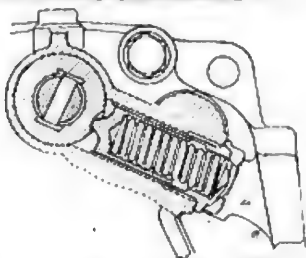
20 23 041

Insert detent balls.
Insert locking balls and press down.
Push 4th/5th gear selector rod through up to lock in this position.



20 23 042

Mount 4th/5th gear selector fork with a 6 x 24 mm pin.



20 23 044

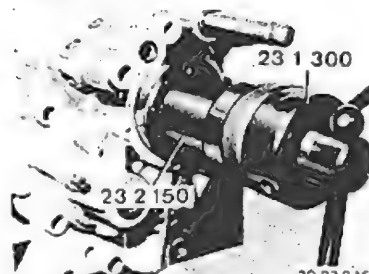
Install lockpin.
Check installed position.
Coat bearing surface of plug with a surface sealant**.
Tightening torque*.



20 23 045

Install all plugs and backup light switch.

* See Specifications
** Source: HWB

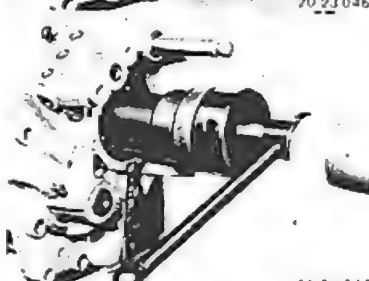


23 2 150

23 1 300

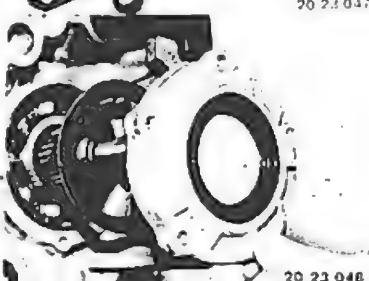
20 23 046

Install and pull grooved ball bearing into rear case section with Special Tools 23 1 300 and 23 2 150.



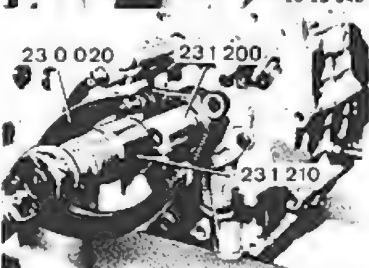
20 23 047

Drive in grooved ball bearing to fit tight by applying light knocks.



20 23 048

Install gasket.
Insert spacer and mount cover.
Tightening torque*.



23 0 020

23 1 200

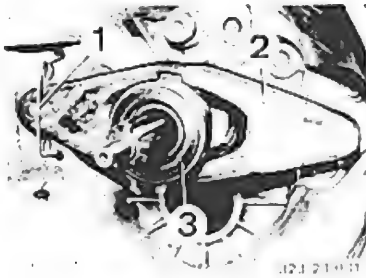
23 1 210

20 23 093

Mount output flange.
Install collar nut with bolt cement**.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Tighten collar nut with Special Tool 23 1 210.
Tightening torque*.
Install lockplate.

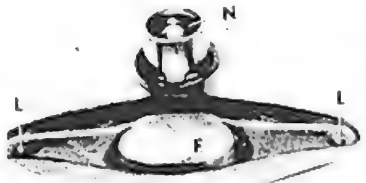
* See Specifications
** Source: HWB

23-147



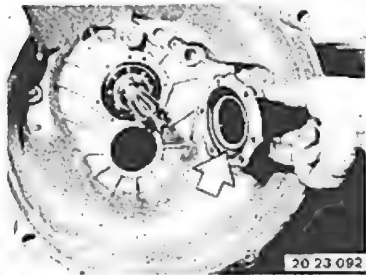
23 11 622 REMOVING AND INSTALLING/ REPLACING CLUTCH RELEASE GUIDE SLEEVE —TRANSMISSION REMOVED—

Lift out spring (1) and remove release lever (2) with thrust bearing (3).



Installation:
Pack lubricating groove (N) with Molykote Longterm 2.
Coat guides (F) and bearings (L) with Molykote Longterm 2.
Non-conformance could cause release bearing to seize on guide sleeve.

320 23 043



Detach guide sleeves.

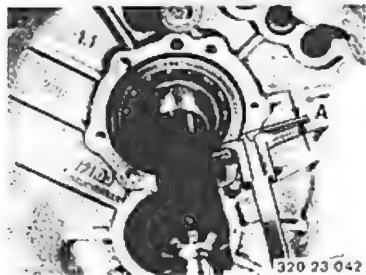
Important!

Spacer.

Installation:

Install guide sleeve with surface sealant**.
Sealing surface must be cleaned thoroughly and dried of oil.

Tightening torque*.



Installation:

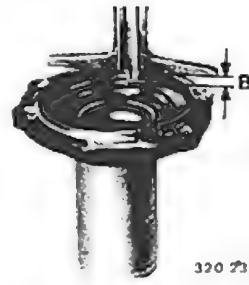
If applicable, correct play to 0 ... 0.09 mm (0 ... 0.0035") with a shim.

Determine thickness of shim (spacer).

Measure distance (A) from bearing outer race to case sealing surface.

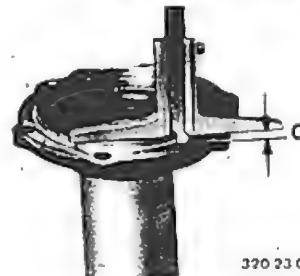
320 23 042

- * See Specifications
- ** Source: HWB



Measure distance (B) from guide sleeve protrusion to inside surface.

320 23 043



Measure distance (C) from guide sleeve protrusion to outside surface.

Example:

B	4.0 mm (0.157")
+ A	0.3 mm (0.012")
C	4.3 mm (0.169")
- C	2.8 mm (0.110")

1.5 mm (0.059") spacer thickness

320 23 044

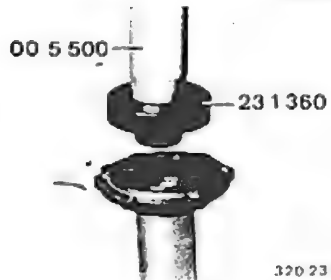
23-148

23 12 502 REPLACING RADIAL OIL SEAL FOR INPUT SHAFT —TRANSMISSION REMOVED—

Remove guide sleeve 23 11 622.
Lift out radial oil seal.



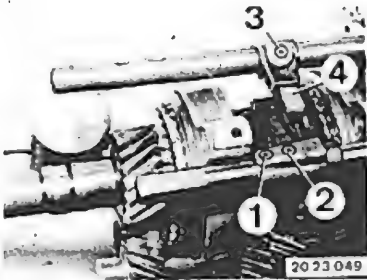
320 23 048



Drive in radial oil seal with Special Tools
23 1 360 and 00 5 500.
Open end faces transmission case.
Lubricate sealing lip with oil.

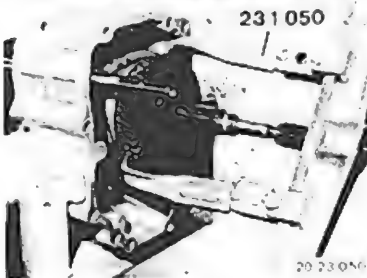
320 23 049

23-149

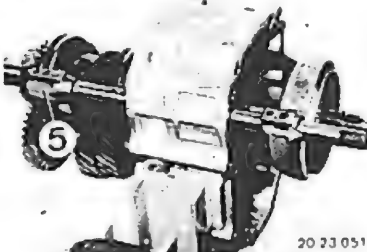


23 21 501 REMOVING AND INSTALLING INPUT AND OUTPUT SHAFT ASSEMBLY – FRONT AND REAR CASE SECTIONS REMOVED

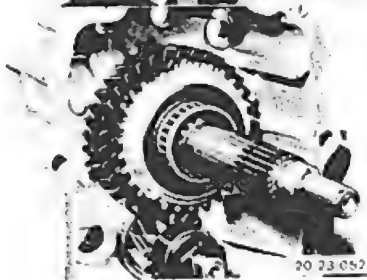
Drive out pins (1 ... 3) while counterholding.
Installation:
Replace pins.
Pull out selector shaft toward rear.
Remove selector arm (4).
Two rollers on selector shaft.



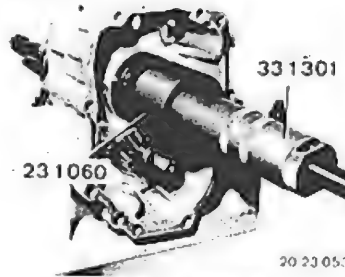
Pull spacer, reverse gear and bearing sleeve off of output shaft with Special Tool 23 1 050.



Take off dog (5).
Pull out selector rod with selector fork and guide sleeve toward rear.



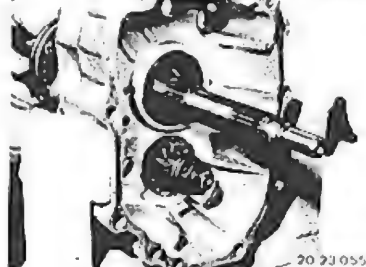
Remove synchromesh ring and 1st gear with needle bearing.



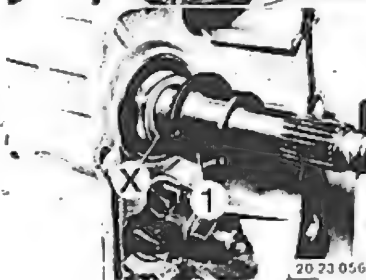
Pull bearing sleeve off of output shaft with Special Tools 23 1 060 and 33 1 301.
Important!
Shim (X).



Heat intermediate case in area of layshaft bearing to approx. 80° C (175° F) with a hot air blower.
Pull input shaft/output shaft and layshaft out of intermediate case.
Installation:
Check condition of all bearings, replacing if necessary (see 23 21 703).

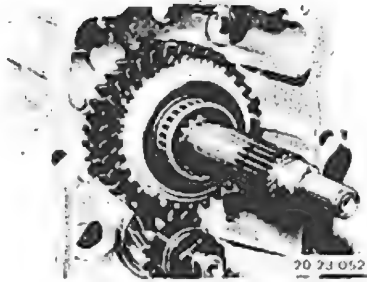


Installation:
Heat intermediate case in area of layshaft bearing to approx. 80° C (175° F) with a hot air blower.
Install input shaft/output shaft and layshaft.

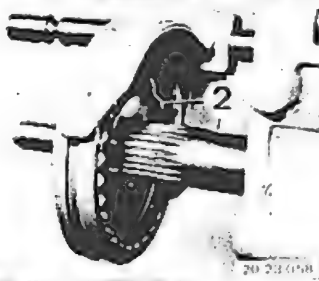


Install shim (X) on output shaft.
Heat bearing sleeve (1) to approx. 80° C (175° F) with a hot air blower and install on output shaft.

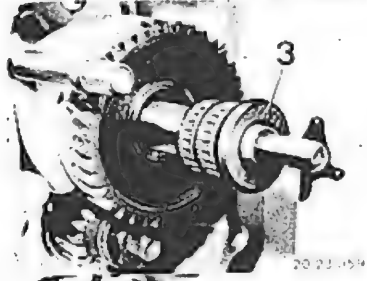
23-150



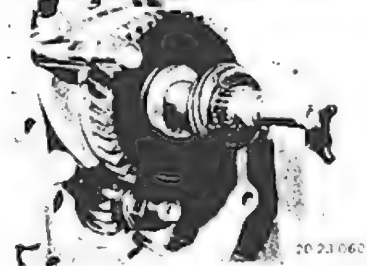
Install needle bearing, 1st gear and synchromesh ring on output shaft.



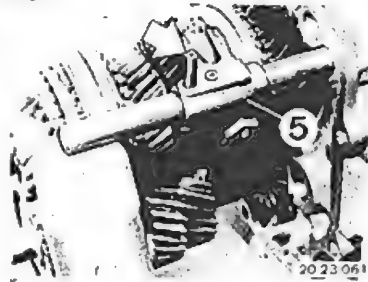
Insert 1st/reverse gear selector rod with selector fork in intermediate case. Run guide sleeve into selector fork that synchromesh spring (2) faces 1st gear.



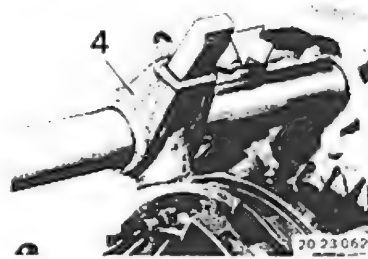
Slide guide sleeve on to spline of output shaft. Important! Guide tabs on 1st gear synchromesh ring into guide sleeve. Install reverse gear and split needle bearing. Heat bearing sleeve (3) to approx. 80° C (175° F) with a hot air blower and slide on to output shaft.



Install spacer.



Slide on dog (5) and secure with 6 x 26 mm pins (counterhold). Install 2nd/3rd and 4th/5th gear selector forks.



Push in selector shaft. Slide selector arm (4) on to selector shaft in such a manner that bevel on arm faces dog.



Mount selector arm with a 6 x 28 mm pin (counterhold). Openings in selector shaft must face out. Install two rollers on selector shaft with grease.

23-151

23 21 552 REPLACING OUTPUT SHAFT - Output Shaft Removed -

Pull off input shaft (1), synchronesh ring (2) and needle bearing (3).

Note:
To avoid mixing up synchronesh rings while disassembling the output shaft, it is recommended to mark synchronesh rings for pertinent gear wheels.

Lift out snap ring (4).
Take off shim (5).

Installation:
Eliminate all play between the snap ring and guide sleeve.
Replace snap ring (4).

Take off guide sleeve, synchronesh ring, 4th gear wheel and split needle bearing.

Important! - Installation:
The stepped end of the operating sleeve faces the 5th gear wheel.

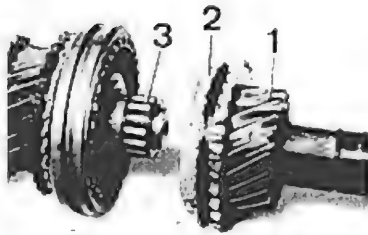
Press bearing inner race, bearing sleeve, 2nd gear wheel, synchronesh ring, needle bearing, guide sleeve, synchronesh ring, 3rd gear wheel and needle bearing off of the output shaft.

Important!
Split needle bearing:
Slots without needles are provided at angles of 90° and 120° to guarantee uniform bearing of the needles.

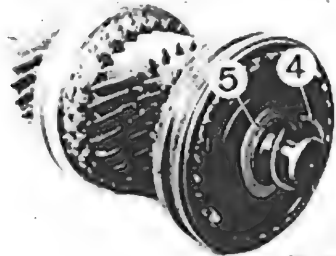
Place needle bearing, 3rd gear wheel, synchronesh ring, guide sleeve, synchronesh ring, needle bearing and 2nd gear wheel on the output shaft. Press on bearing sleeve (1) with Special Tool 23 1 160.

Important!
Guide the needle bearing into the bearing sleeve.

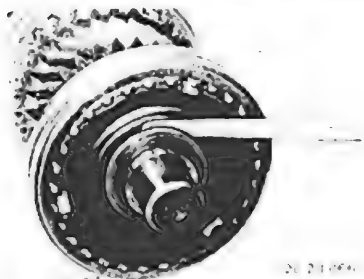
Press on bearing inner race (2) with Special Tool 23 1 160.



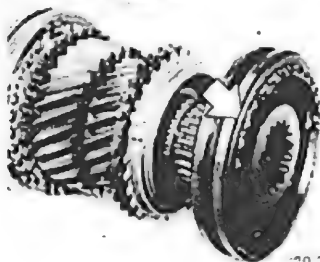
20 23 064



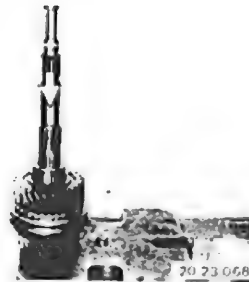
20 23 065



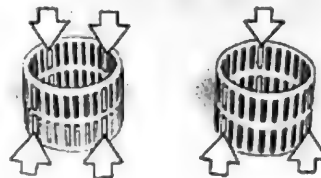
20 23 066



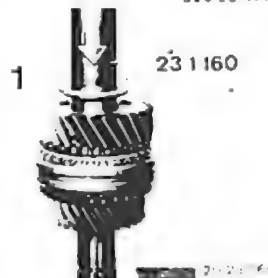
20 23 067



20 23 068

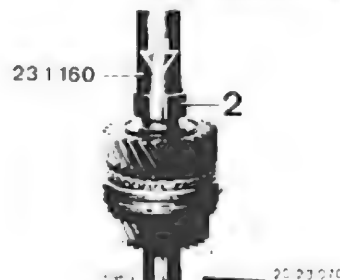


320 23 114



23 1 160

20 23 069



23 1 160

20 23 070

23-152



20 23 071

Determine thickness of shim X.
Measure distance (A) from collar of output
shaft to bearing inner race.



20 23 072

Pull operating sleeve off of 1st/reverse gear
guide sleeve.
Installation
Install operating sleeve that its flat teeth
slide over the pressure pieces.



20 23 073

Insert reverse gear bearing sleeve in guide
sleeve.
Measure distance (B) from guide sleeve
collar to bearing sleeve.

Example:

A	46.8 mm (1.842")
- B	46.3 mm (1.822")
X	0.5 mm (0.020")

23-154

23 21 703 REPLACING BEARINGS OF ALL TRANSMISSION SHAFTS - Transmission Removed -

A) Input Shaft, Layshaft in Front Case Section:

Remove transmission case - see 23 11 005.
Remove end plug (1).

Installation:

Replace end plug and install with sealing compound**.
Remove grooved ball bearing.

Heat transmission case in area of bearing to about 80° C (175° F) with a hot air blower.
Install grooved ball bearing.

Adjust axial play of layshaft.
Determine thickness of spacer (2) between bearing and layshaft.

Measure distance (A) from case sealing surface to grooved ball bearing.

** Source: HWB

Measure distance (B) from layshaft to sealing surface.

Example:

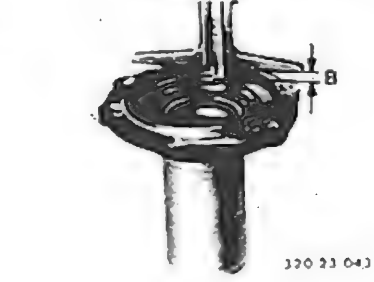
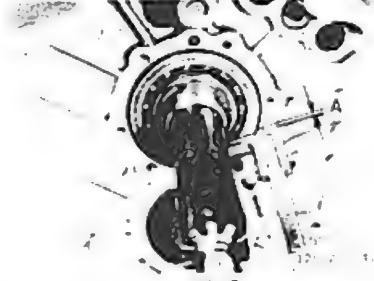
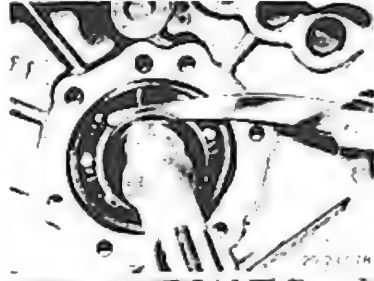
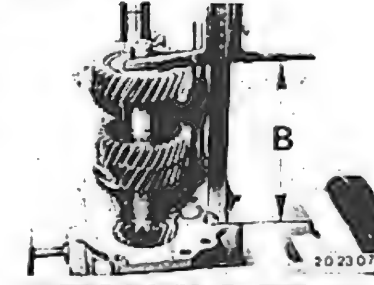
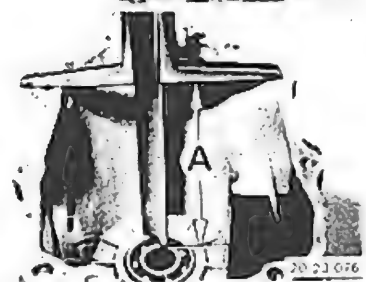
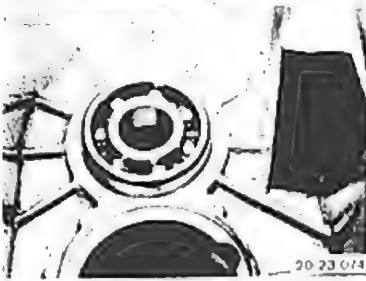
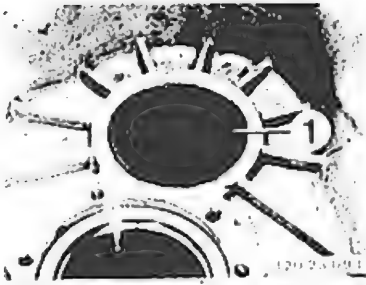
A	155.8 mm (6.134")
- B	155.3 mm (6.114")
	0.5 mm (0.020")
-	0.1 ... 0.2 mm (0.004 ... 0.008") axial pl.
	0.3 ... 0.4 mm (0.012 ... 0.016") spacer

Install front case section.
Adjust play between circlip and bearing inner-race to 0 ... 0.09 mm (0 ... 0.0035") with shims.

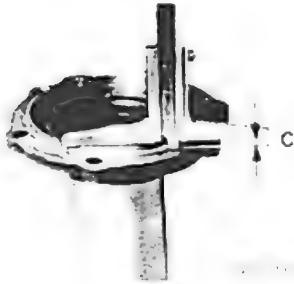
Adjust play between guide sleeve and bearing outer race to 0 ... 0.09 mm (0 to 0.0035") with shims.

Measure distance (A) from case sealing surface to bearing outer race.

Measure distance (B) from guide sleeve protrusion to inside surface.



23-155



Measure distance (C) from guide sleeve protrusion to outside surface.

Example:

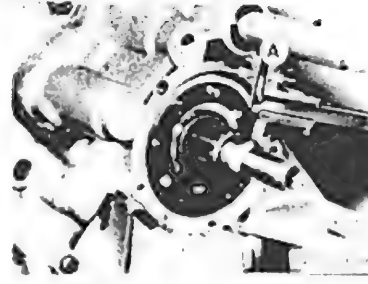
B	4.0 mm (0.157")
+ A	0.3 mm (0.012")
	4.3 mm (0.169")
- C	2.8 mm (0.110")

1.5 mm (0.059") spacer

B) Output Shaft in Rear Case Section:

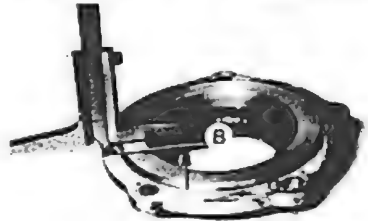
Remove rear case section 23 11 040.

Press in grooved ball bearing to fit tight in rear case section. Check distance (A), adjusting with shim X betw. bearing and spacer if necessary.



Eliminate play between grooved ball bearing and cover.

Measure distance (A) from case cover to grooved ball bearing.



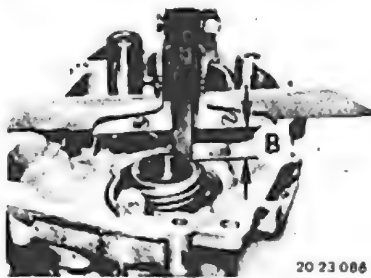
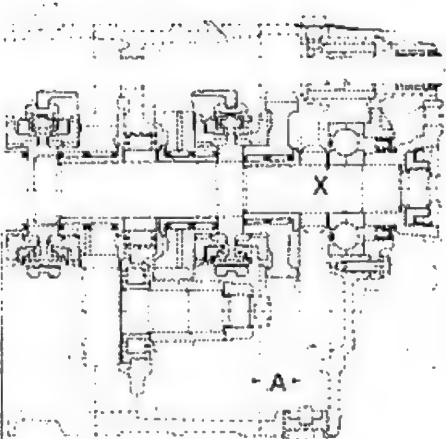
Measure collar height (B), without gasket.

Important!

Use 0.2 mm (0.008") for gasket thickness in calculations.

Example:

A	3.0 mm (0.118")
- B	2.9 mm (0.114")
	0.1 mm (0.004")
+	0.2 mm (0.008") gasket thickness
	0.3 mm (0.012") shim thickness

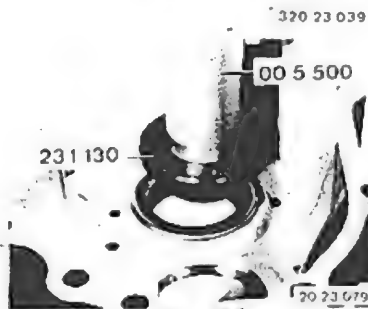


Install spacer on grooved ball bearing.

Measure distance (B) from sealing surface to spacer.

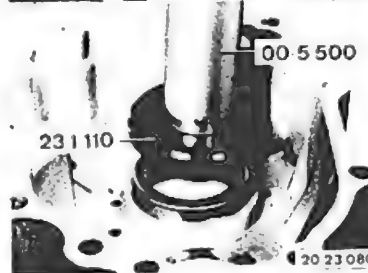
Example:

A	22.0 ± 0.1 mm (0.866 ± 0.004") nominal
- B	21.6 mm (0.850")
	0.4 mm (0.016") spacer



C) Output Shaft, Layshaft in Intermediate Case:
Remove input/output shaft assembly — see 23 21 501.

Drive out roller bearing for output shaft with Special Tools 23 1 130 and 00 5 500.



Drive in roller bearing with Special Tools 23 1 110 and 00 5 500.

23-156

1

Unscrew collar nut (1).

Installation:

Install collar nut with bolt cement**.

Tightening torque*.

2

Pull off gear (2).

3

Take off roller bearing.

Press bearing inner race (3) off of layshaft with, if necessary, Special Tool 00 7 500.

23 1 160

Install bearing inner race (3) with collar facing gear and press on with Special Tool 23 1 160.

3

* See Specifications

** Source: HWB

23-157

23 23 004 DISASSEMBLING/ASSEMBLING COMPLETE SYNCHRONIZATION — Transmission Removed —



Remove input and output shaft assembly

23 21 501.

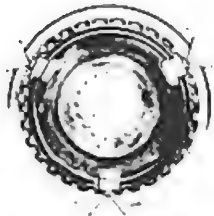
Disassemble output shaft 23 21 552.

All synchronesh rings are identical and coated with molybdenum on inside.

Check distances* between synchronesh ring and clutch.

Measure in area of stops.

Synchronesh rings should support uniformly on entire surface.



Press operating sleeve off of synchronizer.

Installation:

Install operating sleeve that its flat teeth slide over pressure pieces.



Offset hooks of synchronesh springs in an axial groove to each other.

Engage pressure pieces in synchronesh springs.

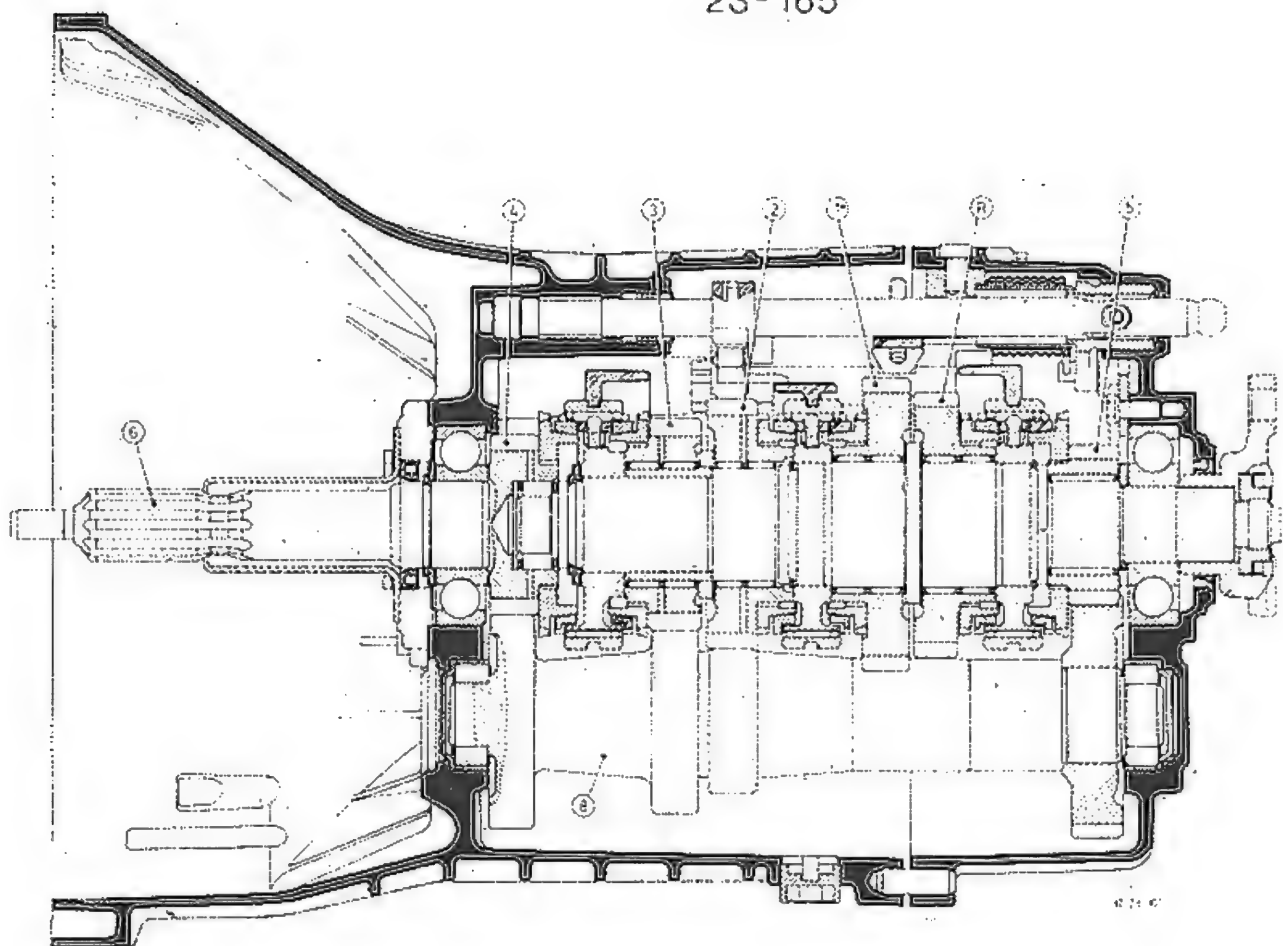
* See Specifications

Construction group 23 Manual transmission

Getrag 260 Five speed overdrive transmission

	Assembly drawing – transmission	23-	165
	Assembly drawing – shift components	23-	166
23 11 013	Transmission case front section – remove and install / seal	23-	169
623	Guide sleeve for clutch release – remove and install	23-	171
23 12 503	Radial oil seal for input shaft – replace	23-	173
23 21 503	Input and output shaft assembly – remove and install	23-	174
554	Output shaft – replace	23-	179
703	Bearings for all transmission shafts – replace	23-	185
23 23 505	Synchronisation – disassemble and assemble	23-	189

23-165



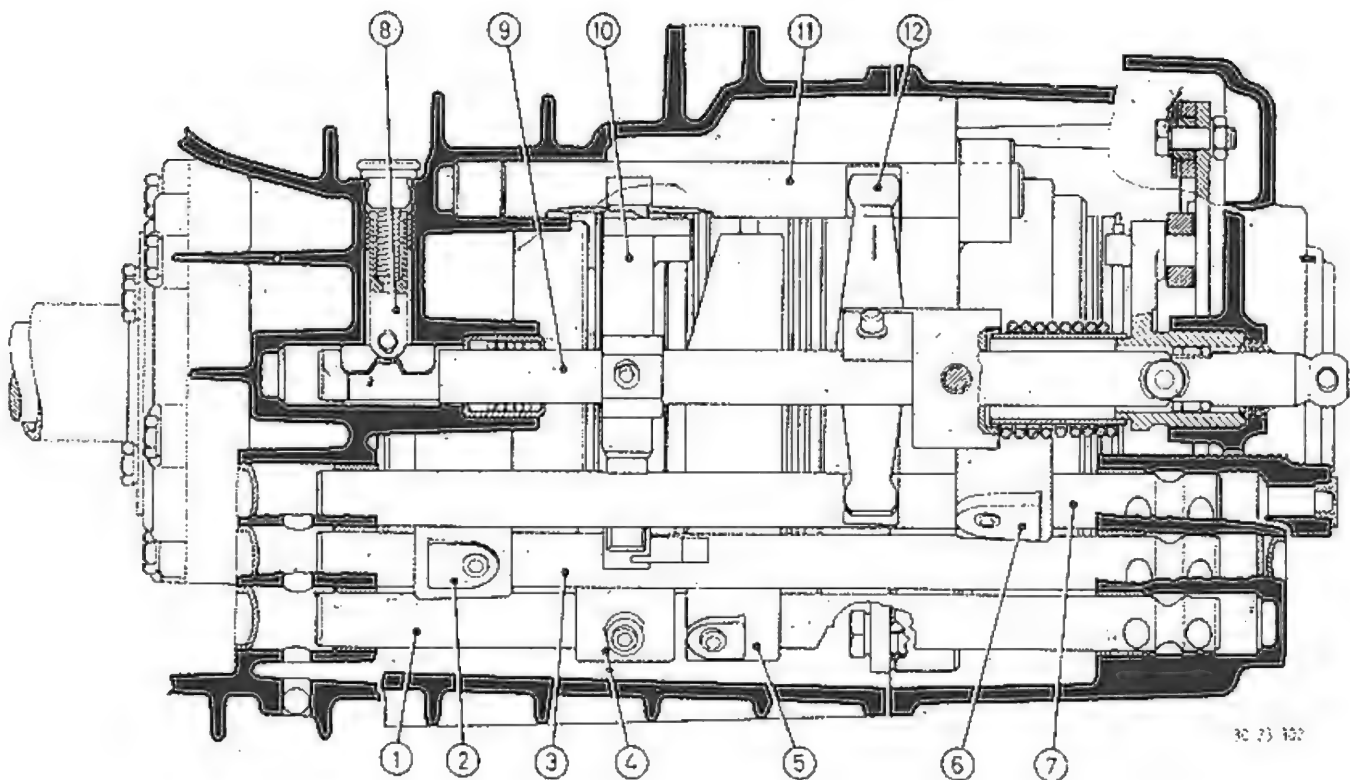
ASSEMBLY DRAWING OF GETRAG 260 FIVE SPEED OVERDRIVE MANUAL TRANSMISSION

1 First gear
2 Second gear
3 Third gear

4 Fourth gear
5 Fifth gear
6 Reverse gear

7 Input shaft
8 Output shaft
9 Layshaft

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ASSEMBLY DRAWING OF SHIFT MECHANISM FOR GETRAG 260 FIVE SPEED OVERDRIVE MANUAL TRANSMISSION

1 Selector rod - 1st/2nd gear
2 Selector fork - 3rd/4th gear
3 Selector rod - 3rd/4th gear
4 Dog

5 Selector fork - 1st/2nd gear
6 Selector fork - reverse/5th gear
7 Selector rod - reverse/5th gear
8 Lockpin

9 Selector shaft
10 Selector arm
11 Selector rail
12 Operating lever

23-169

23 11 013 REMOVING AND INSTALLING OR SEALING FRONT CASE SECTION

Remove transmission - see 23 00 022 in model repair manual beginning with 1985 models.
Mount Special Tool 23 0 090 on Special Tool 00 1 490.
Mount transmission on special tool.
Drain oil.

General Information:

A stronger 5-speed overdrive transmission type 260/6 is installed in cars with M 30 engine, 3.2 or 3.4 liter, since 9.85. Identification: additional cooling ribs on lower case section.
The 260/6 overdrive transmission is included in the following description for the former 260/5 transmission.
Transmission Type 260/6 is mentioned when procedures deviate.

Remove guide sleeve - see 23 11 623.
Unscrew backup light switch.
Lift out cover (1).
Pull out spring (2) and lockpin (3).
Check installed position!

Lift out snap ring (4).
Take off washer (5).

Installation:
Always replace the snap ring.

Unscrew bolt (6).

Installation:
Install bolt with a bolt cement**.
Tightening torque*.

Drive out cylindrical pin.
Unscrew bolts.

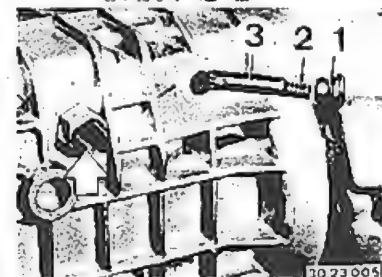
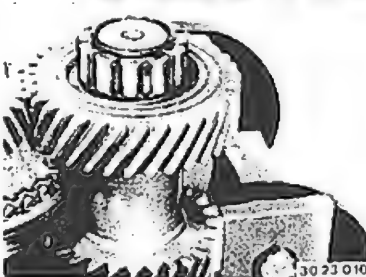
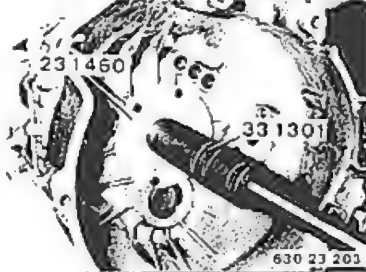
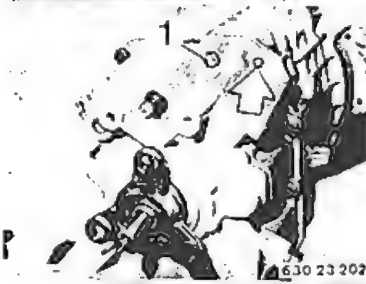
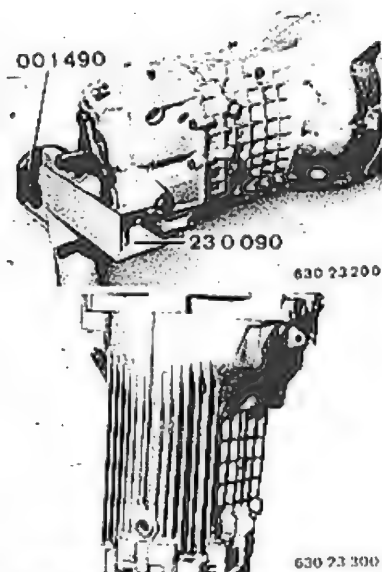
Installation:
Check length of bolts.
Bolt (1) = 8 x 60 mm.

Pull off front case section with Special Tools 23 1 460 and 33 1 301.

Place roller bearing on the layshaft in such a manner that the small diameter faces up.

Note:
To avoid seizure of the rollers while mounting the front case section, coat rollers with grease and press in.

* See Specifications
** Source of Supply: HWB



23-170

Coat front case section in area of the reverse gear shaft with a surface sealing compound**. Surface must be cleaned thoroughly and dried of oil.

Remove grooved ball bearing for input shaft.
Important! - Installation
Inner race of the grooved ball bearing protrudes.
Install with protrusion face the gear set.

Unscrew oil drain plug.
Coat sealing surface with surface sealing compound**. Sealing surface must be cleaned thoroughly and dried of oil.
Mount front case section.
Align intermediate shaft through bore for oil drain plug in such a manner, that roller bearing of intermediate shaft slides into the bearing shell.
Tighten front case section bolts.
Tightening torque*.
Install lockpin and reverse gear switch.

Heat* bearing inner race and front case section in area of grooved ball bearing with a hot air blower.
Push on grooved ball bearing as far as possible.
Protrusion of inner race faces the gear set.

- * See Specifications
- ** Source of Supply: HWB

Press grooved ball bearing on input shaft or into front case section with Special Tools 23 1 007, 23 1 000 and 23 1 006.

Important!
Apply Special Tools 23 1 006 in such a manner, that flat ends face the input shaft.

Drive on grooved ball bearing further continuously and simultaneously apply light knocks from a hammer.

Transmission 260 / 6 or 260 Sport:
The front case section cannot be pressed on due to the uniform thickness of the input shaft.
Double bearing is installed in the front case section.

Heat bearing inner race to about 80° C (175° F) with a hot air blower.

Caution!
Protect plastic cage against heat.
Mount front case section, whereby the input shaft must be pulled out.
Tighten front case section bolts.
Tightening torque*.

Install shim and circlip.
Reduce any possible play between the bearing inner race and circlip to 0 ... 0.09 mm (0 to 0.0035").

- * See Specifications

23-171

23 11 623 REMOVING AND INSTALLING GUIDE SLEEVE FOR CLUTCH RELEASE (Transmission Removed)

Lift out spring (1) and remove release lever (2) with bearing (3).

Installation:
Fill lubricating groove N with Molykote Longterm 2.
Coat guides F and bearings L with Molykote Longterm 2.
Non-conformance could cause the release bearing to seize on the guide sleeve.

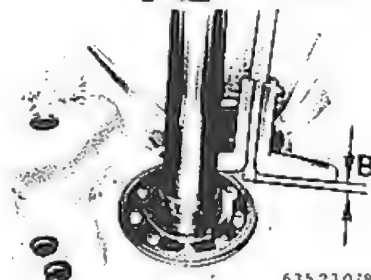
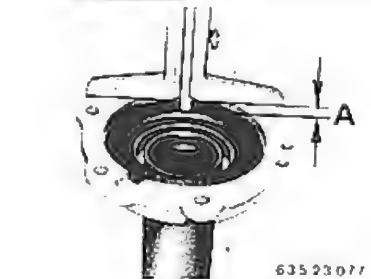
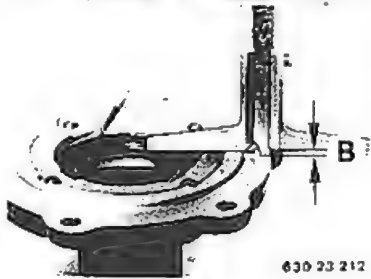
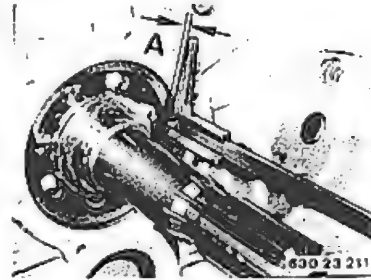
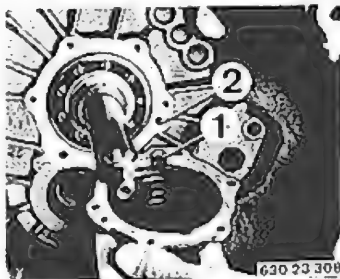
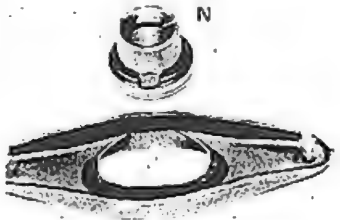
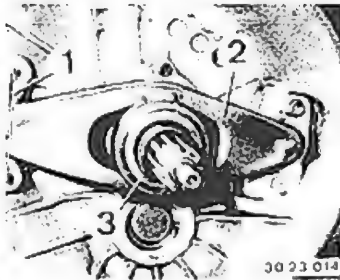
Important!
Use Microtube 261** for version with a double-mass flywheel.

Unscrew guide sleeve.

Important!
Spacer.

Installation:
Mount guide sleeve that oil groove (1) is aligned with oil bore (2) in transmission case, or "up/down" marks on guide sleeve are aligned and arrow on face points to middle of layshaft. Install guide sleeve and bolts with a sealant**.
Sealing surface and bolts must be cleaned thoroughly and dried of oil. Tightening torque*.

* See Specifications
** Source of Supply: HWA



Installation:
Adjust any play to 0 ... 0.09 mm (0 to 0.0035").
Determine thickness of spacer.
Measure distance (A).

Measure distance (B).

Example:
A 3.0 mm (0.118")
B 2.6 mm (0.102")
Spacer 0.4 mm (0.016")

260/6 or 260 Sport Transmission:

Installation:
Adjust any play to 0 ... 0.09 mm (0 to 0.0035").
Determine thickness of spacer.
Measure distance (A).

Measure distance (B).

Example:
A 3.0 mm (0.118")
B 2.6 mm (0.102")
Spacer 0.4 mm (0.016")

23-173

23 12 503 REPLACING RADIAL OIL SEAL FOR INPUT SHAFT - Transmission Removed -

Remove guide sleeve - see 23 11 622.
Unacrew guide pipe.

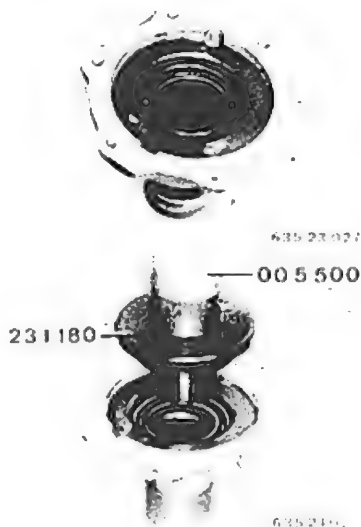
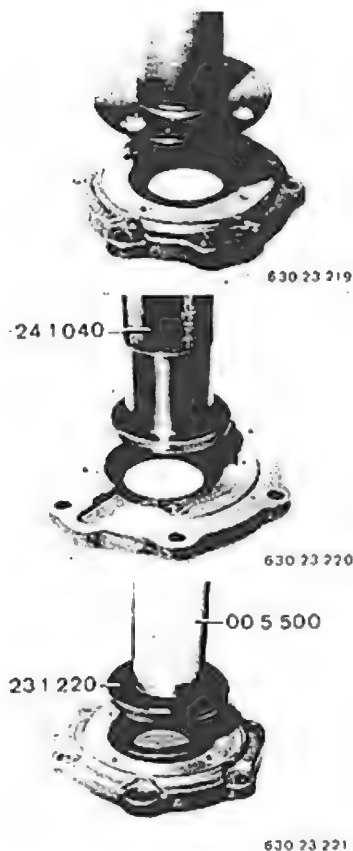
Installation:
Install guide pipe and bolts with a surface
sealing compound**. Sealing surface and bolts must be cleaned
thoroughly and dried of oil.
Tightening torque*.

Important!
Collar on inside surface of flange.
Drive out radial oil seal in direction of the
guide pipe with Special Tool 24 1 040.

Drive in radial oil seal with Special Tools
23 1 220 and 00 5 500.
Lubricate sealing lip of radial oil seal with
oil.

Transmission 260 / 6 or 260 Sport:
Lift out radial oil seal.

Drive in radial oil seal with Special Tools
23 1 180 and 00 5 500.
Open end faces up.
Lubricate sealing lip with oil.



* See Specifications
** Source of Supply: HWB

23-174

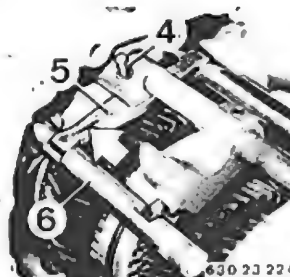
23 21 503 REMOVING AND INSTALLING INPUT AND OUTPUT SHAFT ASSEMBLY — Transmission Removed —

Remove transmission case front section —
23 11 013.
Remove lockplate.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.
Version with Integrated Vibration Damper:
Hold output flange with Special Tool 23 1 320.

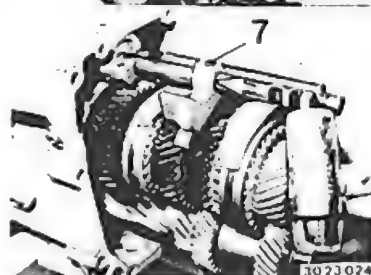
Pull off output flange with Special Tool
23 1 150

Unscrew bolt (1).
Remove holder (2).
Unscrew bolt (3).

Remove shaft with reverse gear and needle
bearing.



Pull out pin (4) for operating lever (5).
Pull out selector rail (8).
Remove operating lever (5).
Installation:
Install operating lever that notch faces up and
in direction of selector rail.



Engage 4th gear.
Drive in pin (7), while counterholding.
Important!
Only drive in pin (7) far enough that selector
shaft can be pulled back and out.

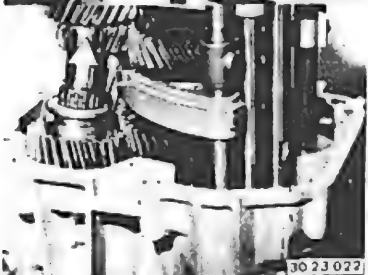
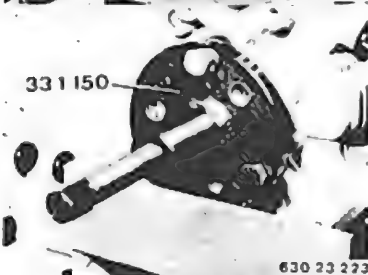


Radial oil seal (8) will also be pulled out.
Important!
Rollers on selector shaft.
Installation:
Replace radial oil seal.
Remove selector arm.



Detach end plate.
Installation:
Install end plate with sealing compound**.
Sealing surface must be cleaned thoroughly and
dried of oil.
Remove end plate (9).
Installation:
Replace end plate.

** Source: HWB



23-175

Remove 3 springs and 3 balls.
Note:
 Springs differ in length (see installation).

23 1050

Press input shaft, output shaft and layshaft out of case rear section with Special Tool 23 1 050.
Important!
 To avoid damage on sealing surface, use a piece of wood, aluminum or similar material between claws and sealing surface.

Drive out pin (10) in 3rd/4th gear selector fork.
Installation:
 Replace pin.

Important!
 Be careful not to clamp selector rods and layshaft while pressing out parts.
 Layshaft must not tilt off in this step.
Installation:
 Check condition of all bearings, replacing if necessary.

Knock out 3rd/4th gear selector fork forward.
Important!
 Lockpin (11) in selector fork.

Installing:
 Install 3rd/4th gear selector fork and 1st/2nd as well as 5th/reverse gear selector rods with selector forks.
 Check thrust washer (1) (only for 260/5).

Engage 2nd and reverse gears by pushing 1st/2nd and 5th/reverse gear selector rods forward.

Remove all detent and locking balls from case rear section.
 Install roller bearing with large diameter facing out.
 Lubricate lockpins and locking levers with oil.
 Transmission 260/6:
 The radial oil seal for the output flange and the ball bearing inner race must be removed prior to installation of the input and output shafts.

23-176

Heat grooved ball bearing inner race in rear case section to about 80° C (175° F) with a hot air blower. 2nd and reverse gears are engaged. Install input shaft, output shaft and layshaft in rear case section. Align shift rods.

Pull input shaft, output shaft and layshaft into rear case section with Special Tools 23 1 300 and 23 2 150.

Important!
Make sure shift rods and layshaft are not clamped while pulling in.

Note:
Screw Special Tool 23 1 301 between both above mentioned special tools for the version with a longer output journal.

260/6 Transmission:
Install input shaft and output shaft with 3rd/4th gear shift forks and 1st/2nd and 5th/reverse gear shift rods or layshaft in the rear case section. Heat bearing inner race (1) to about 80° C (175° F) with a hot air blower and slide it on the output shaft, pressing on with Special Tool 23 1 160 if necessary.

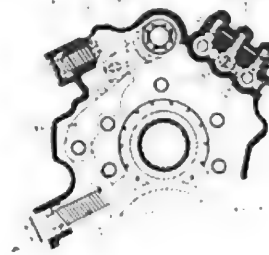
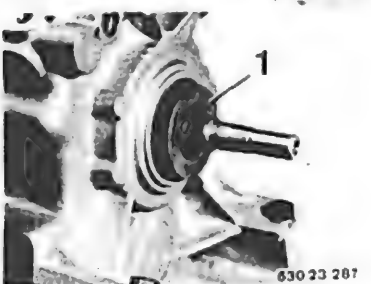
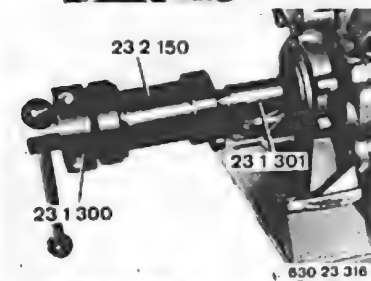
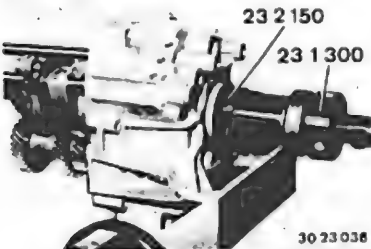
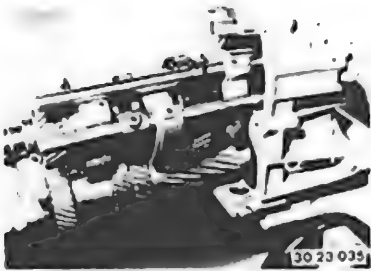
Drive in radial oil seal flush with Special Tool 23 1 370. Lubricate sealing lip with oil.

Move shift rods into neutral position. Push 3rd/4th gear shift rod through the shift forks. Place lockpin (1) in the shift rod with grease. Push in shift rod up to the bore. Opening on shift rod faces up.

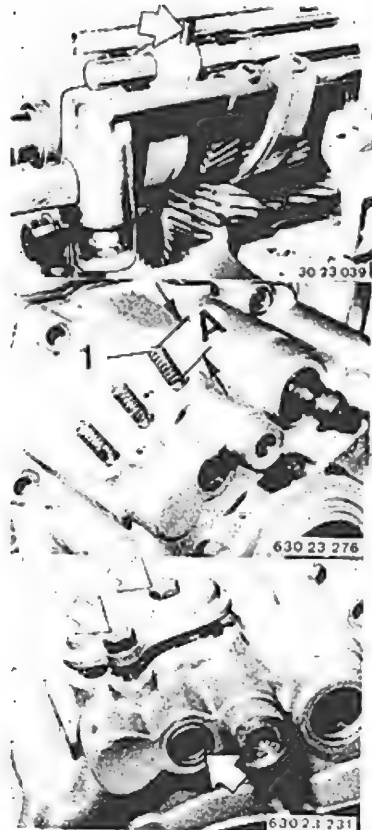
Insert two locking balls with grease. Push in 3rd/4th gear shift rod up to the arrest.

Arrest Assembly:

- 1 Cap
- 2 Spring
- 3 Dentent ball
- 4 Locking ball
- 5 Lockpin
- 6 Selector arm
- 7 Lockpin
- 8 Spring
- 9 Locking lever
- 10 Spring



23-177



Drive 6 x 26 mm pin into 3rd / 4th gear selector fork (counterhold).

Install 3 locking balls and 3 springs.
Important!
Version with Different Length Springs:
Install short spring (1) with relaxed length
(A) = 15.9 mm (0.626") for 5th/reverse
gear selector rod.

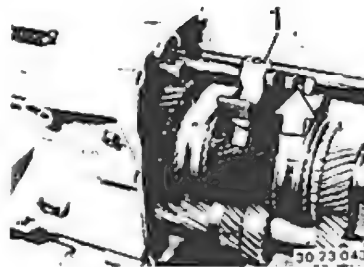
Install end cap after coating with sealing
compound**.
Install end cover with sealing compound**.

Drive pin out of selector arm.

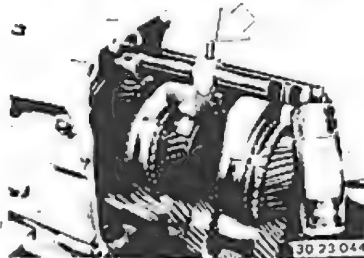


30 23 042

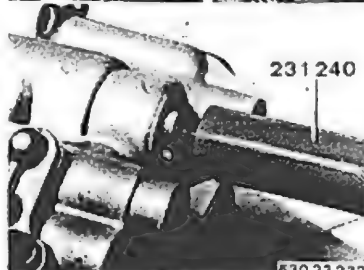
** Source: HWB



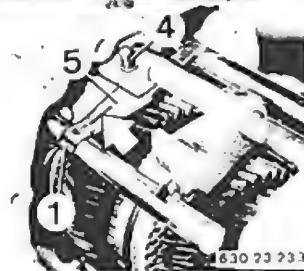
Slide in selector shaft in position with grease.
Slide in selector shaft and install selector arm
(1) at same time.
Important!
Opening in selector shaft faces out.



Drive in 6 x 26 mm pin (counterhold).



Lubricate sealing lip of radial oil seal with oil.
Drive in radial oil seal with Special Tool
23 1 240.



Install selector rail.
Groove (1) in selector rail faces up.
Install operating lever (5) with notch facing
up and toward selector rail.
Install pin (4).

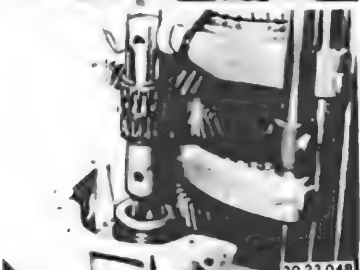
23-178

Coat case rear section in area of reverse gear shaft with sealing compound**. Surface must be cleaned thoroughly and dried of oil.



630 23 214

Install shaft with needle bearing and reverse gear.



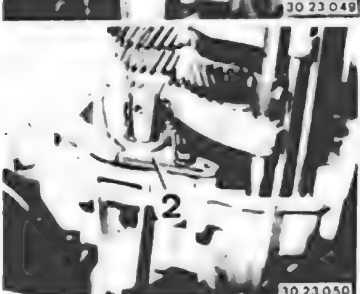
30 23 048

Mount shaft with bolt (3).
Install bolt with a bolt cement**.



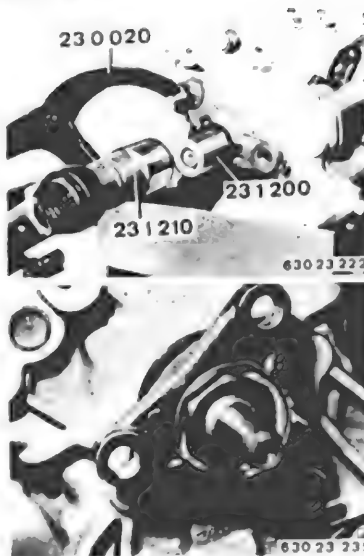
30 23 049

Insert holder (2), press out and secure in this position.



30 23 050

** Source: HWB



23 0 020

23 1 200

23 1 210

630 23 222

Install output flange.
Install collar nut with a bolt cement**. Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Tighten collar nut with Special Tool 23 1 210.
Tightening torque*.
Version with Integrated Vibration Damper:
Hold output flange with Special Tool 23 1 320.

Install lockplate.



630 23 233

* See Specifications
** Source: HWB

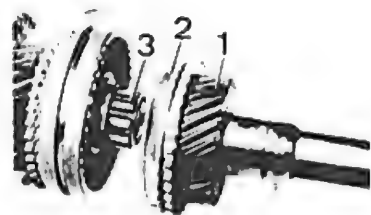
23-179

23 21 554 REPLACING OUTPUT SHAFT — Output Shaft Removed —

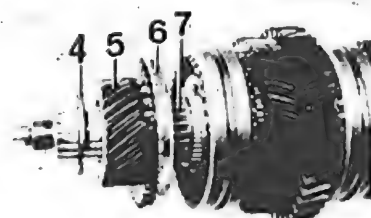
Pull off input shaft (1), synchronesh ring (2) and needle bearing (3).

Note:

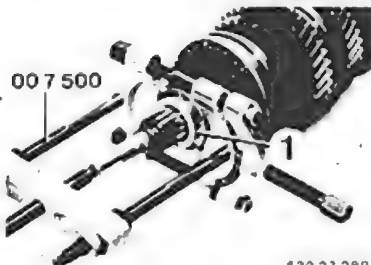
Synchronization:
To avoid mixing up synchronesh rings, it is recommended to mark synchronesh rings and corresponding gear wheels when disassembling the output shaft.



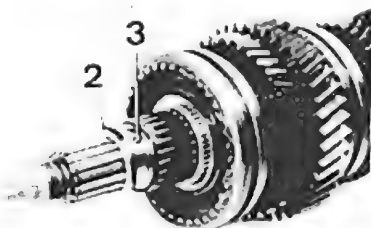
630 23 236



630 23 237



630 23 289



630 23 290

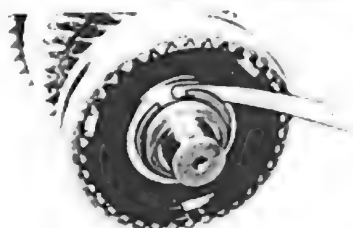
Pull off thrust washer (4), 5th gear (5), synchronesh ring (6) and needle bearing (7).

Transmission 260/6:
Pull ball bearing inner race (1) off of the output shaft with Special Tool 00 7 500.

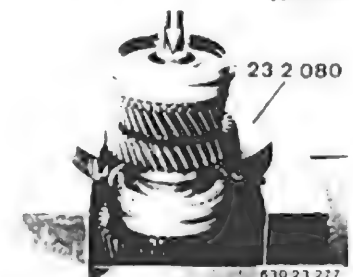
Transmission 260/6:
Pull off 5th gear wheel and synchronesh ring. Take off thrust washer (2) and ball (3). Pull off needle bearing.



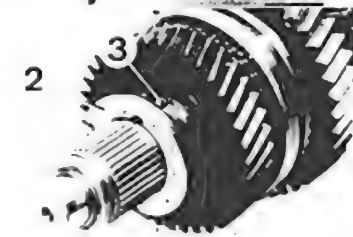
630 23 238



630 23 239



630 23 277



630 23 291

Lift out circlip (8).
Remove spacer (9).
Installation:
Always replace circlip.

Installation:
Adjust play between circlip and guide sleeve to 0... 0.09 mm (0 to 0.0035").

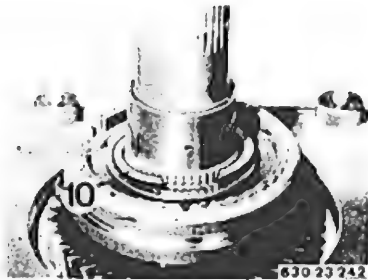
Press 2nd gear, bearing sleeve, 3rd gear, synchronesh ring and guiding sleeve with sliding sleeve off of output shaft with Special Tool 23 2 080.
Pressing off force*.

Transmissions 260/6 and 260/5:**
Note thrust washer (2) and ball (3) between 2nd and 3rd gear wheels.

* See Specifications
** Since 7.85

23-180

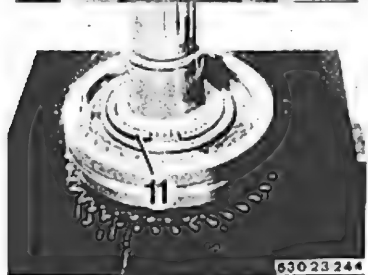
Important!
Circlip (10) must be removed before pressing off the first gear wheel.
Installation:
Always replace circlip.



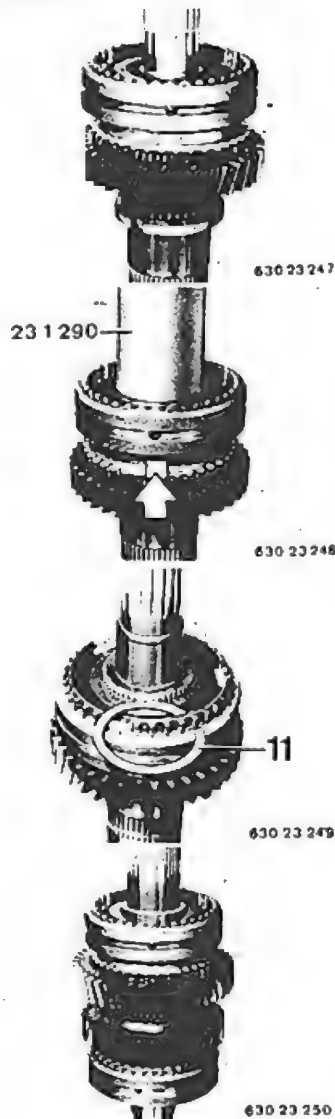
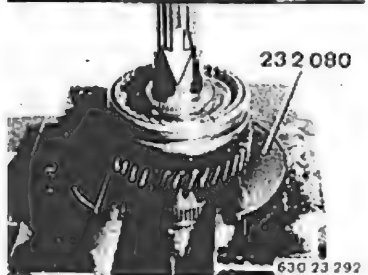
Press off 1st gear wheel and guide as well as operating sleeve with Special Tool 23 1 490.
Take off needle bearing.
Pressing-off force*.



Important!
Circlip (11) must be removed before pressing off the reverse gear wheel.
Installation:
Always replace circlip.s



Press off guide as well as operating sleeve and reverse gear wheel with Special Tool 23 2 080, with the bottom end facing the gear wheel.
Take off needle bearing.
Pressing-off force*.



Assembling:

Note:
Check wear of synchromesh rings before assembling (see 23 23 505).
Install needle bearing, reverse gear wheel and synchromesh ring.
Slide guide and operating sleeve on splines of the output shaft.
Transmission 260/6 and 260/5** or 260 Sport:
Shouldered end of operating sleeve faces reverse gear wheel or, for version with 1 groove, 5th gear wheel.

Press on guide sleeve to fit tight with Special Tool 23 1 290.
Pressing-on force*.

Important!
Make sure tabs on synchromesh ring are aligned with openings in the guide sleeve while pressing on.

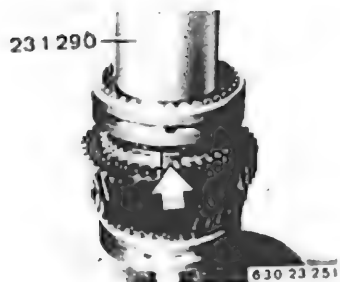
Move operating sleeve in direction of reverse gear wheel.
Adjust guide sleeve to be without play with circlip (11).
Circlips are available from Parts in different thicknesses between 1.7 and 2.0 mm (0.067 and 0.079").
Install circlip (11).

Install needle bearing, 1st gear wheel and synchromesh ring.
Slide guide and operating sleeves on the splines of the output shaft.
Transmission 260/6 and 260/5** or 260 Sport:
Shouldered end of operating sleeve faces the 1st gear wheel or, for version with 2 grooves, 2nd gear wheel.

* See Specifications

* See Specifications
** Since 5.85

23-181



Press on guide sleeve to fit tight with Special Tool 23 1 290.
Pressing-on force*.
Important!
Make sure tabs on synchromesh ring are aligned with openings in the guide sleeve while pressing on.



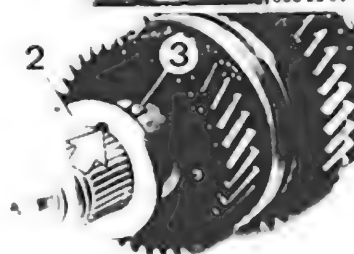
Move operating sleeve in direction of the 1st gear wheel.
Adjust guide sleeve to remove all play.
Circlips are available from Parts in different thicknesses between 1.7 and 2.0 mm (0.067 and 0.079").
Install circlip (10).



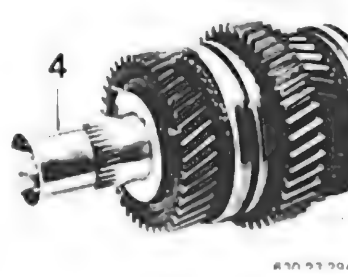
Install needle bearing, synchromesh ring and 2nd gear wheel.
Important!
Collar for bearing sleeve on the output shaft must protrude slightly.
If necessary, check whether circlip (10) seats correctly.



Heat bearing sleeve to about 80° C (175° F) with a hot air blower and install on the output shaft.



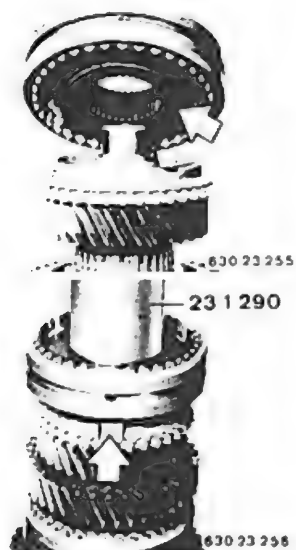
Transmission 260/6 and 260/5** or 260 Sport:
Install ball (3) and thrust washer (2) with the opening facing ball (3).



Transmission 260/6 and 260 Sport:
Heat bearing sleeve (4) without collar to about 80° C (175° F) with a hot air blower and install on the output shaft.

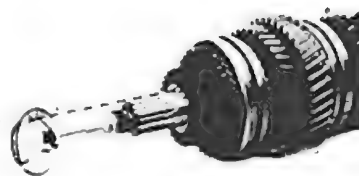
** Since 7.85

23-182

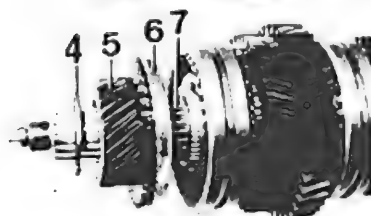


Install needle bearing, 3rd gear wheel and synchronesh ring.
Install guide and operating sleeve on splines with the long collar facing the 3rd gear wheel.
260/5 since 8.85 or 260 Sport:
Shouldered end of operating sleeves faces the 3rd gear wheel or, for version with 3 grooves, the 4th gear wheel.
260/6:
Groove for shift fork is off-center.
Wide flat spot on operating sleeve faces the 3rd gear wheel.

Press on guide sleeve to fit tight with Special Tool 23 1 290.
Important!
Make sure that tabs on synchronesh ring are aligned with openings in the guide sleeve while pressing on.
Install shim and circlip.
Pressing-on force*.



Transmission 260/6:
Heat ball bearing inner race to about 80° C (175° F) with a hot air blower and install on the output shaft.
Important!
The opening in the bearing inner race must engage with the ball (turning lock).



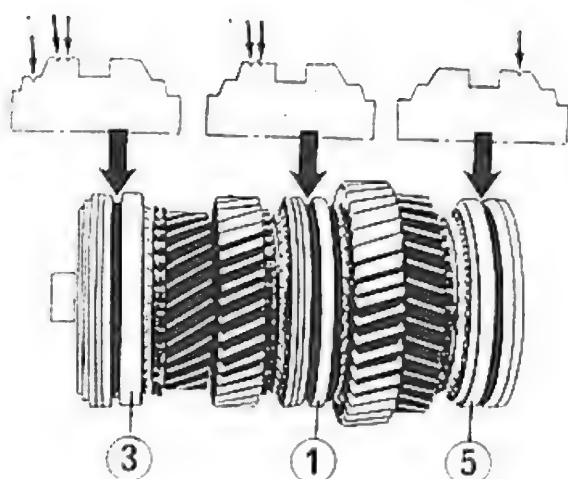
Pull off thrust washer (4), 5th gear wheel (5), synchronesh ring (6) and needle bearing (7).



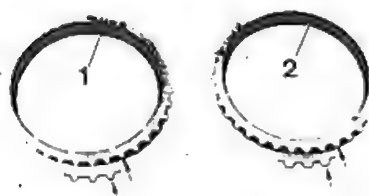
Transmission 260/6:
Slide needle bearing on output shaft.
Insert ball (3).
Install thrust washer (2) with opening facing the ball.
Install synchronesh ring and 5th gear wheel.

• See Specifications

23-183



630 23 312



630 23 305

Transmission 260/5:

Note:

Modified synchronization since 5.85 with new gear wheels, synchronesh rings, guide and operating sleeves, guides, balls and springs.

Identification: grooves in operating sleeves (check installed position).

Operating sleeves are machined asymmetrically.

Operating sleeve (1), marked with 2 grooves, is installed with shouldered end facing 1st gear wheel or grooves facing 2nd gear wheel.

Operating sleeve (3), marked with 3 grooves, is installed with shouldered end facing 3rd gear wheel or grooves facing 4th gear wheel.

Operating sleeve (5), marked with 1 groove, is installed with shouldered end facing reverse gear wheel or grooves facing 5th gear wheel.

Identification of Synchronesh Rings:

To avoid mixing up synchronesh rings among each other, it is important to note the drawing number and tooth width.

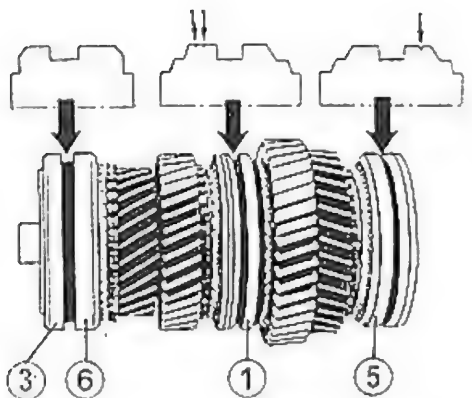
Synchronesh ring (1) for 1st/reverse gears has stamped drawing no. 011.8.0241.00 and narrow teeth.

Synchronesh ring (2) for 2nd ... 5th gears has stamped drawing no. 011.8.0161.00 and wide teeth.

Important!

Modified shift components cannot be used in transmissions manufactured before 5.85 (shifting problems).

23-183 a



630 23 313

Transmission 260/6:

Note:

Operating sleeves are machined asymmetrically (check installed position).
Install operating sleeve (1) for 1st/2nd gears, marked with 2 grooves, that grooves face the 2nd gear wheel.

Operating sleeve (3) for 3rd/4th gears, without grooves, groove for shift fork is off center.

Install operating sleeve that wide land (6) faces the 3rd gear wheel.

Install operating sleeve (5) for 5th/reverse gears with one groove that groove faces the 5th gear wheel.



630 23 208

Identification of Synchronesh Rings:

To avoid mixing up synchronesh rings among each other, it is important to note the drawing number and tooth width.

Synchronesh rings for 1st/reverse gears have engraved drawing no. 011.8.0241.10 and narrow teeth.

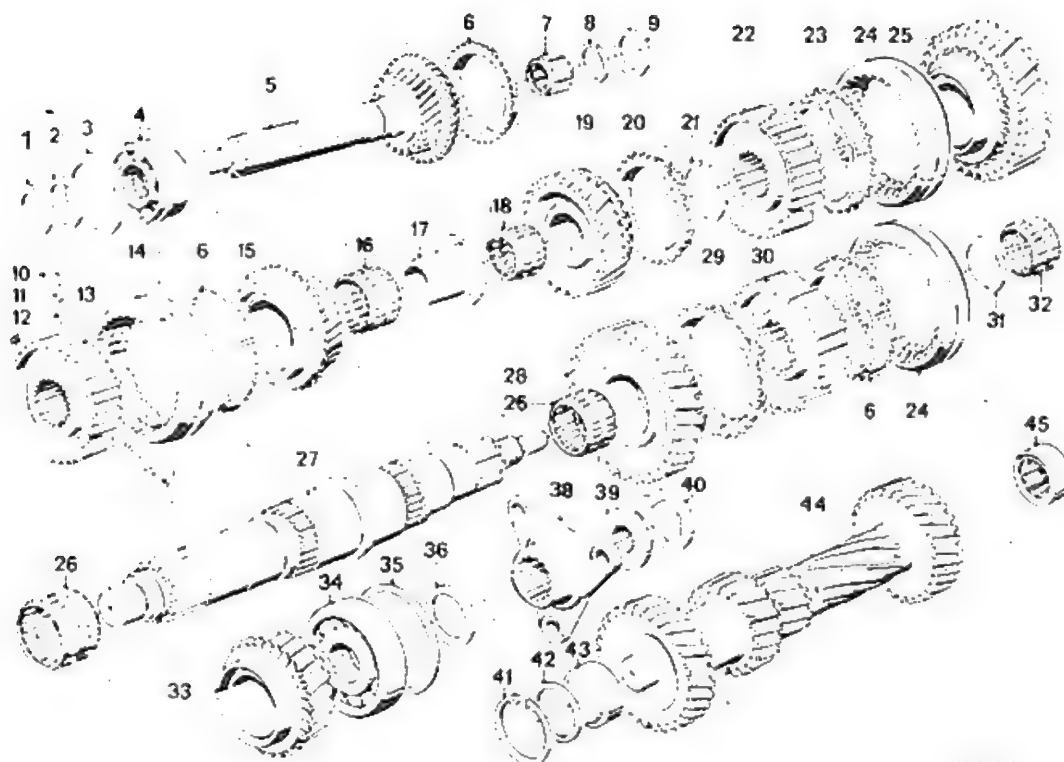
Synchronesh ring for 2nd gear has engraved drawing no. 011.8.0161.2.

Synchronesh ring for 5th gear has engraved drawing no. 011.8.0161.00.

Synchronesh rings for 2nd ... 5th gears have wide teeth.

23-184

Layout of Gear Set and Bearings



30 23 10-2

- 1 Circlip
- 2 Spacer
- 3 Spacer
- 4 Bearing
- 5 Input shaft with 4th gear
- 6 Synchromesh ring
- 7 Needle bearing
- 8 Circlip
- 9 Spacer
- 10 Dog
- 11 Ball
- 12 Spring
- 13 Guide sleeve
- 14 Operating sleeve
- 15 3rd gear
- 16 Needle bearing
- 17 Spacer
- 18 Needle bearing
- 19 2nd gear
- 20 Synchromesh ring
- 21 Circlip
- 22 Guide sleeve
- 23 Synchromesh ring
- 24 Operating sleeve
- 25 1st gear
- 26 Needle bearing
- 27 Output shaft
- 28 Reverse gear
- 29 Synchromesh ring
- 30 Guide sleeve
- 31 Circlip
- 32 Needle bearing
- 33 5th gear
- 34 Bearing
- 35 Spacer
- 36 Spacer
- 38 Output flange
- 39 Collar nut
- 40 Lockplate
- 41 Circlip
- 42 Spacer
- 43 Bearing
- 44 Layshaft
- 45 Bearing

23-185

23 21 703 REPLACING BEARINGS OF ALL TRANSMISSION SHAFTS - Transmission Removed -

Remove Input/output shaft assembly - see 23 21 503.

A) Input Shaft, Layshaft In Front Case Section

Input Shaft:
Drive out grooved ball bearing with Special Tools 23 1 480 and 00 5 500 - see 23 11 013.

Transmission 260/6:
Drive out double bearing with Special Tools 23 1 410 and 00 5 500.

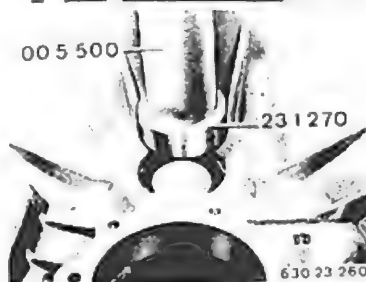
Transmission 260/6:
Heat front case section in area of the bearing to about 80° C (175° F) with a hot air blower.

Important!
Install bearings with rollers for gear wheel set, driving in to fit tight with Special Tools 23 1 470 and 00 5 500.

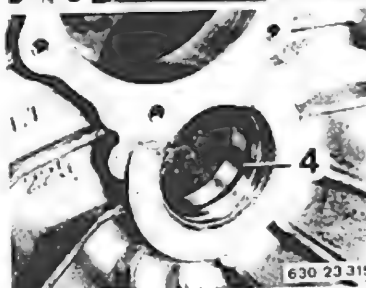
Layshaft:
Loosen circlip (1) with a single knock from Special Tool 23 1 270 used in conjunction with Special Tool 00 5 500.



Lift out circlip (2).
Remove shim (3).

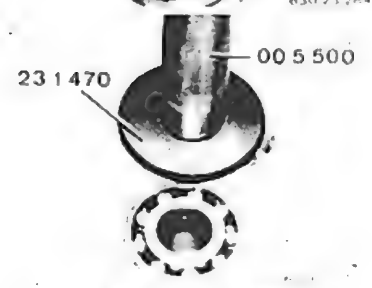
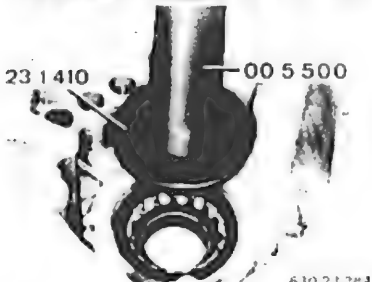
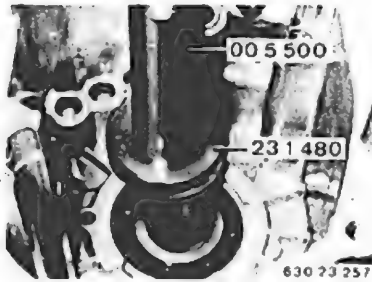


Drive out bearing shell toward inside with Special Tools 23 1 270 and 00 5 500.



Version with O-ring:
Lift out O-ring (4) with a feeler gage blade.

Installation:
Replace O-ring.
Install O-ring in groove and coat it with engine oil prior to installation of the bearing shell.



23-186

B) Output Shaft, Layshaft In Rear Case Section

Output Shaft:
Unscrew bolt (1).

Caution!
Spring force.

Remove spring (2).

Installation:
Install bolt with a bolt cement**. Tightening torque*.

Install Special Tool 23 1 250 for removal of the selector arm.

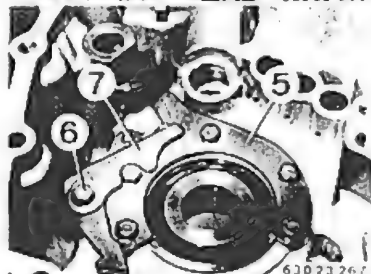
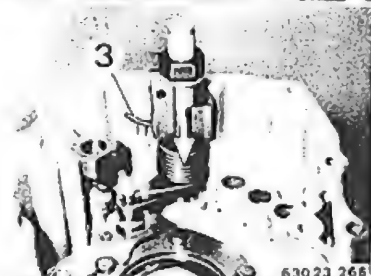
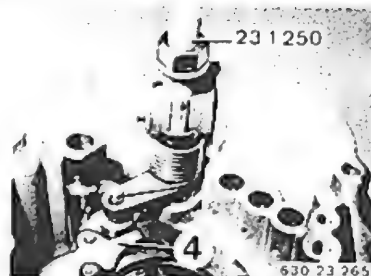
Unscrew socket head screw (3).

Installation:
Install screw with a bolt cement**. Tightening torque*.

Remove selector arm from above.

Important!
Roller.

* See Specifications
** Source of Supply: HWB



Installation:
Insert selector arm with Special Tool 23 1 250.
Swing out selector arm with roller over locking lever (4).

Move end of spring (3) over the raised point into installed position. Press down on the selector arm in this position (do not knock down). Install the socket head screw with a bolt cement** and tighten with correct torque* prior to removal of the special tool.

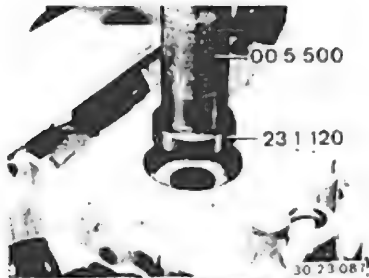
Remove bearing holder (5).

Important!
Do not loosen bolt (6). Locking lever (7) remains on the bearing holder.

Installation:
Check installed position of locking lever (7) and thrust pin (8).

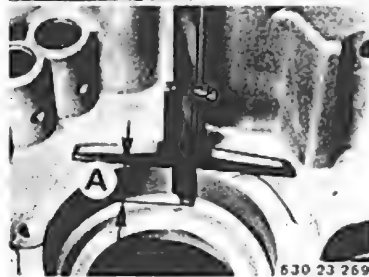
* See Specifications
** Source of Supply: HWB

23-187

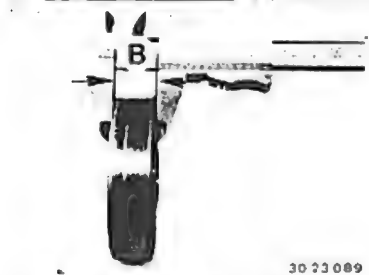


Lift out radial oil seal.
Drive out grooved ball bearing with
Special Tools 23 1 120 and 00 5 500.

Important!
Shim X.



Determine thickness of shim X.
Measure distance (A).



Measure distance (B).

Example:

$$\begin{aligned} A &= 20.3 \text{ mm (0.799")} \\ - B &= 20.0 \text{ mm (0.787")} \\ \hline X &= 0.3 \text{ mm (0.012")} \text{ thick shim} \end{aligned}$$



Heat rear case section in area of the
grooved ball bearing to about 80° C
(175° F) with a hot air blower.
Install shim X.
Install grooved ball bearing.

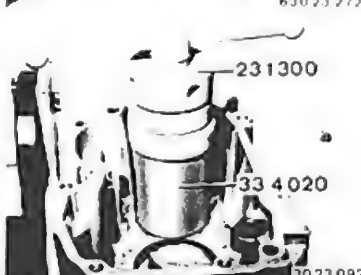
Important!
The grooved ball bearing inner race
has a protrusion which faces the gear
wheel set.
If necessary, drive in against the stop
with Special Tool 23 1 470.



Transmission 260/6:
Split bearing inner races:
The bearing inner race with an open-
ing for a ball (turning lock) must be
installed on the output shaft – see
"Replacing Output Shaft" in 23 21 554.



Layshaft:
Insert the stronger end of Special Tool
23 1 280 in the bearing shell.

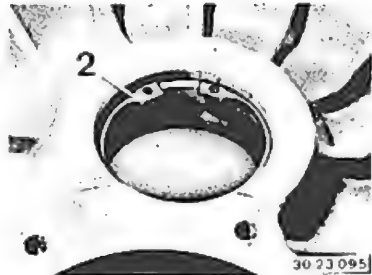


Apply Special Tool 33 4 020.
Screw on Special Tool 23 1 300.
Pull out bearing shell.

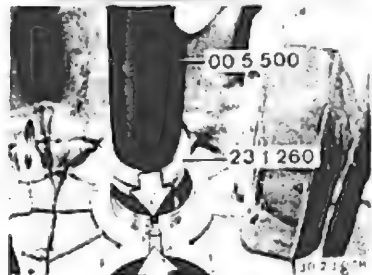


Drive in bearing shell with Special
Tools 23 1 260 and 00 5 500.

23-188



Determining Axial Play of Layshaft:
Install circlip (2).

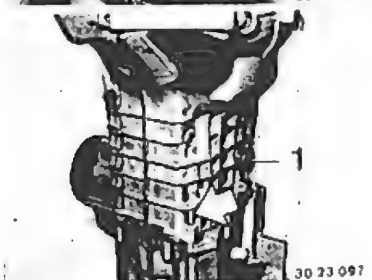


Install old shims.
Drive in bearing shell to fit tight in front case section with Special Tools 23 1 260 and 00 5 500.

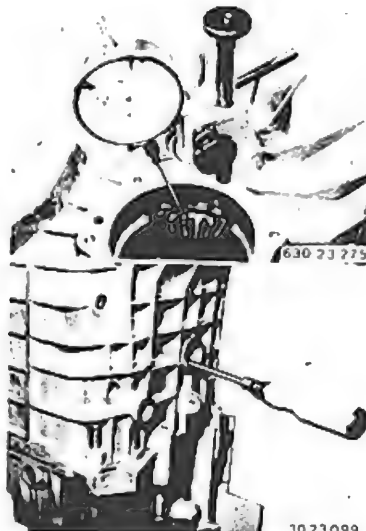
Important!
Oil groove must be aligned with groove in the case.



Place layshaft with roller bearings in the rear case section.



Install and mount front case section with two bolts opposite each other. Center front case section slightly with the dowel pins.
Unscrew oil filler plug (1).



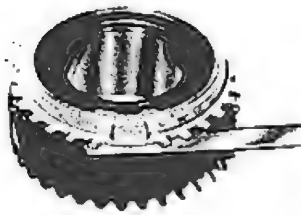
Mount holder with dial gage. Dial gage must be applied on a tooth of the layshaft.

Check axial play of the layshaft through the bore for the oil filler plug. Axial play = 0.13 to 0.23 mm (0.005 to 0.009"). Correct, when necessary, by removing the bearing shell and installing a thicker shim.



Install gear wheel set. Determine thickness of shim for input shaft. Install old shim and circlip. Reduce play to 0 ... 0.09 mm (0 to 0.0035"). Determine thickness of shim for the guide sleeve - see 23 11 623.

23-189



30 23 101

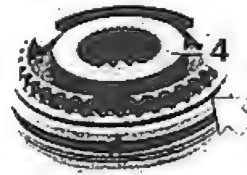
23 23 505 DISASSEMBLING AND ASSEMBLING COMPLETE SYNCHRONIZATION - Output Shaft Removed -

Disassemble output shaft - see 23 21 554.
Note:

Only use molybdenum coated synchronizer rings for repairs.
Check distance* between synchronizer ring and clutch.

Measure in area of stops.

Note:
The synchronizer ring must be pressed on by screwing for measurements.
Synchronizer rings must bear uniformly on the entire surface.

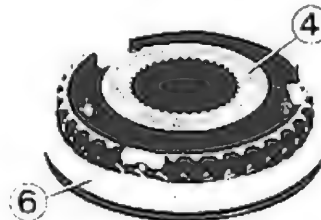


630 23 263

Modified Synchronization Since 5.85:
Sliding sleeves with asymmetric splines.
Thrust pieces (1), spring (2) and balls (3) in weaker version.

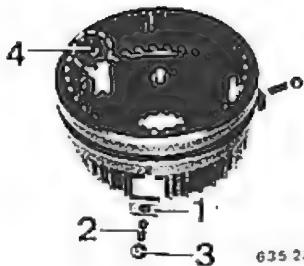
Installation:
Bevelled ends of thrust pieces face the sliding sleeve.

For the 3rd/4th gear guide sleeve it is important to make sure that the bevelled end of sliding sleeve (marked with 3 grooves) faces the long collar (4) of the guide sleeve.



630 23 109

Groove for selector fork is offcenter.
Wide land (5) of sliding sleeve must face long collar (4) of the guide sleeve.



635 23 137

Disassemble synchronization.
Thrust piece (1), spring (2) and ball (3).

Installation:
Bore (4) in operating sleeve must be aligned with ball (3).



30 23 104

Install all springs, thrust pieces and balls.

Important!

Shouldered end of thrust pieces faces sliding sleeve.

Place guide sleeve halfway in sliding sleeve.
Push in balls far enough until guide sleeve can be pressed into sliding sleeve.

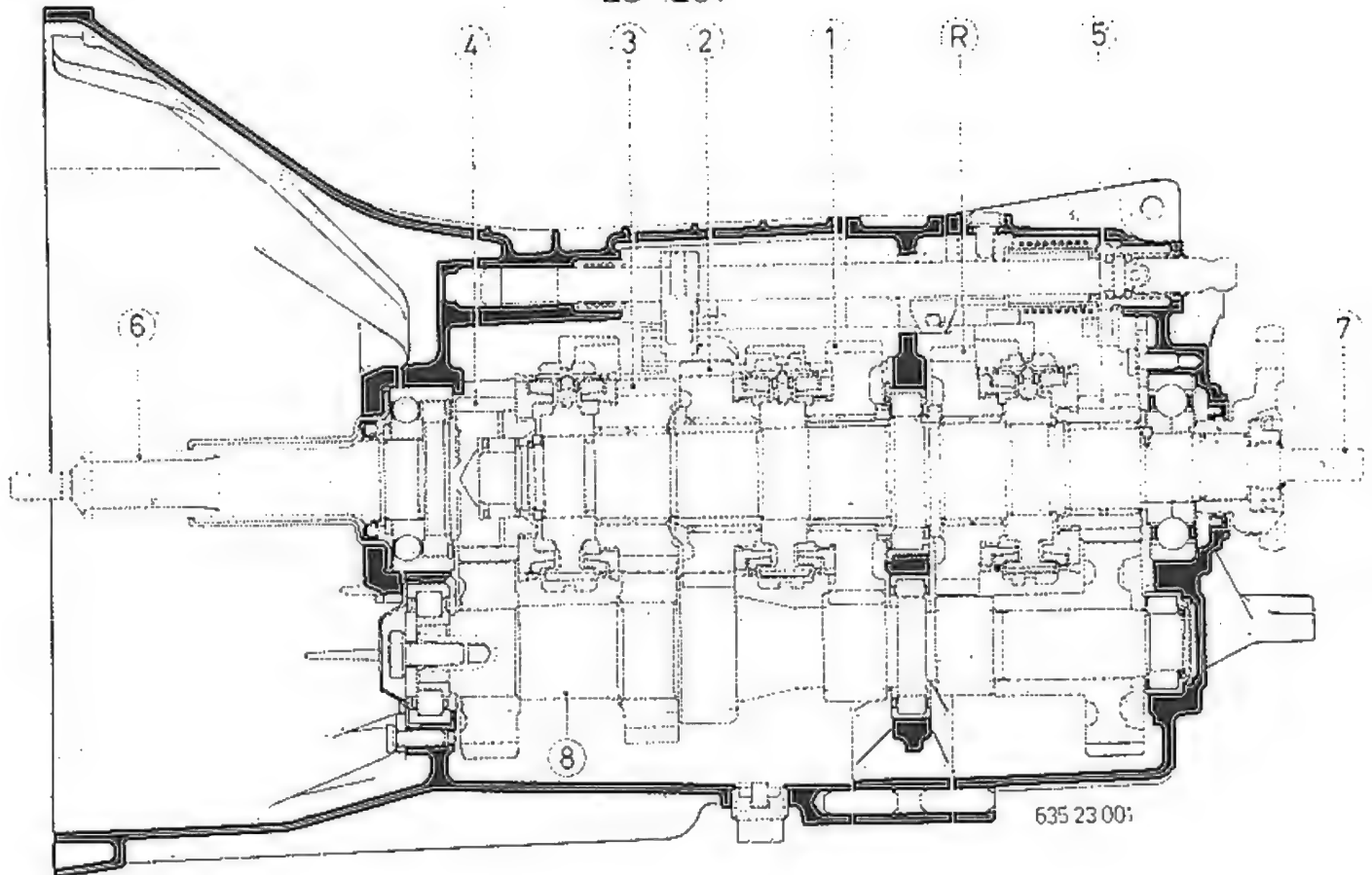
* See Specifications

Construction group 23 Manual transmission

Getrag 280 Five speed sport transmission

	Transmission – assembly drawing	23-	201
	Shift components – assembly drawing	23-	202
23 11 006	Transmission case front and rear sections – remove and install / seal	23-	203
622	Guide sleeve for clutch release – remove and install / seal	23-	210
23 12 502	Radial oil seal for input shaft – replace	23-	211
23 12 501	Input and output shaft assembly – remove and install	23-	212
552	Output shaft – replace	23-	215
702	Bearings for all transmission shafts – replace	23-	220
23 23 504	Synchronisation – disassemble and assemble	23-	224

23-201



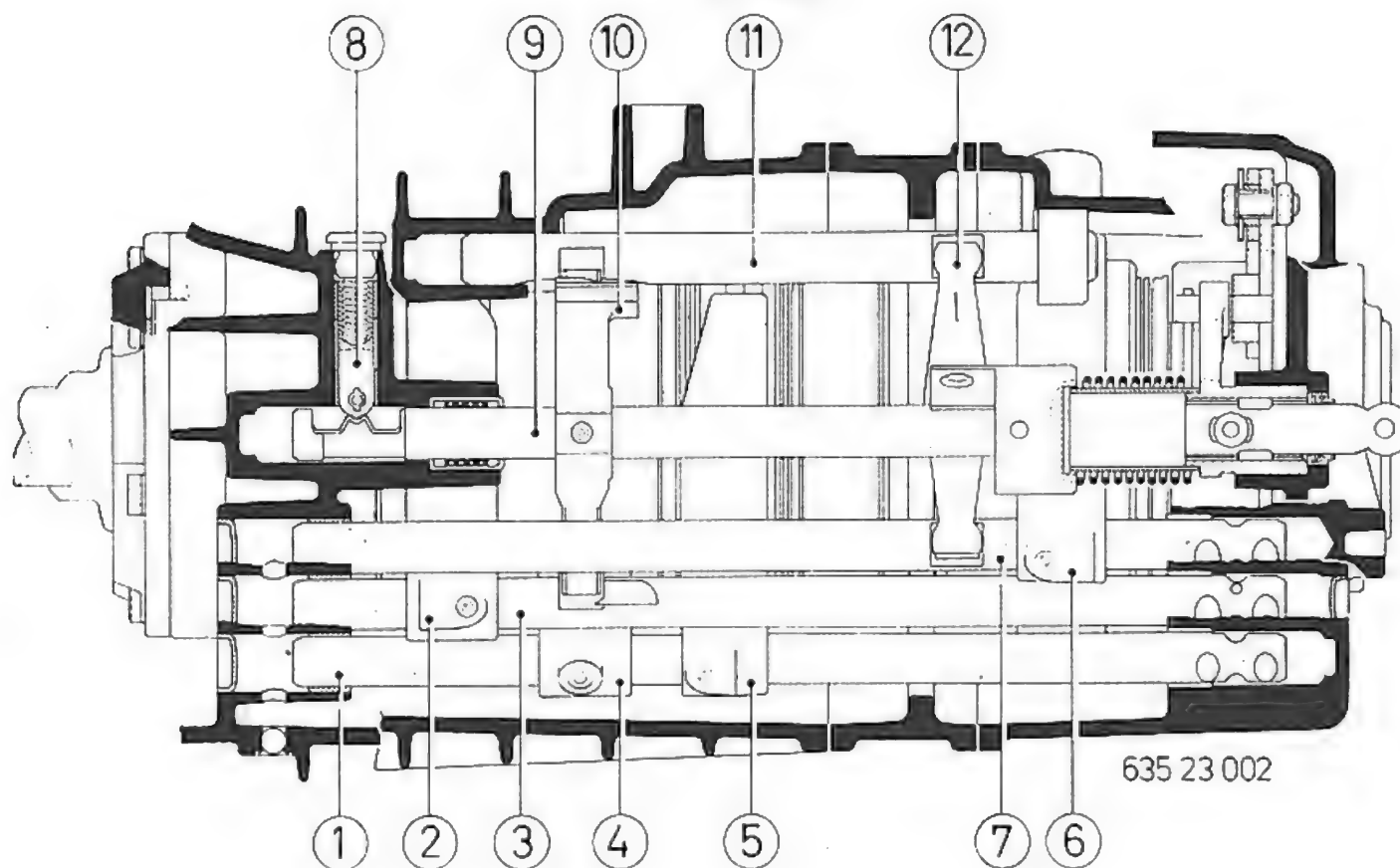
ASSEMBLY DRAWING OF GETRAG 280 FIVE SPEED SPORT MANUAL TRANSMISSION

1 First gear
2 Second gear
3 Third gear

4 Fourth gear
5 Fifth gear
R Reverse gear

6 Input shaft
7 Output shaft
8 Layshaft

23-202



635 23 002

280/Sport Shift Components

- 1 Selector rod - 1st/2nd gear
- 2 Selector fork - 3rd/4th gear
- 3 Selector rod - 3rd/4th gear
- 4 Drive
- 5 Selector fork - 1st/2nd gear
- 6 Selector fork - reverse/5th gear

- 7 Selector rod - reverse/5th gear
- 8 Lockpin
- 9 Shift shaft
- 10 Shift arm
- 11 Shift rail
- 12 Reversing lever

Continued in next column!

23-203

23 11 006 REMOVING AND INSTALLING OR SEALING FRONT AND REAR CASE SECTIONS

Remove transmission – see 23 00 022
In the Model Repair Manual.
Unscrew rubber mounts.

Mount Special Tool 23 0 030 on Special
Tool 00 1 490.
Unscrew filler plug.
Drain oil.
Mount transmission on special tool.

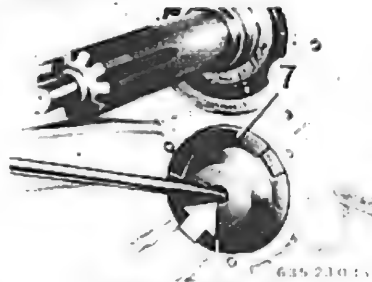
Important!
Use correct oil grade – see Operating
Fluids.
Oil volume*.

Remove guide sleeve – see 23 11 622.
Lift out snap ring (4).
Take off washer (5).

Installation:
Always replace the snap ring.

Unscrew sealing cover mounting bolts.

* See Specifications



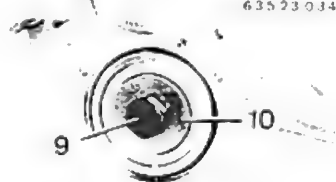
Puncture through the middle of sealing
cover (7).
Pry out sealing cover (7) with a screw-
driver.

Installation:
Replace sealing cover.



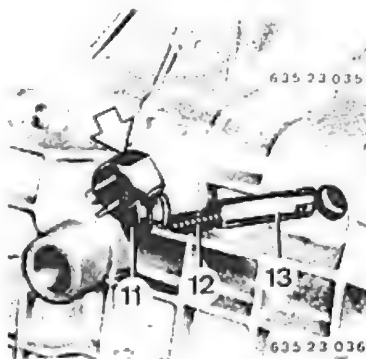
Take off sealing cover.

Important!
Shim (8).



Engage 4th gear.
Unscrew bolt (9) while holding the
output flange with Special Tool
23 0 020.
Take off washer (10).

Installation:
Install bolt (9) with a bolt cement**.

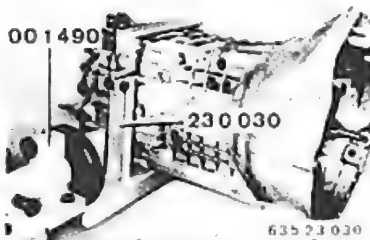


Unscrew backup light switch.
Lift out cover (11).
Pull out spring (12) and lockpin (13).
Check the installed position.

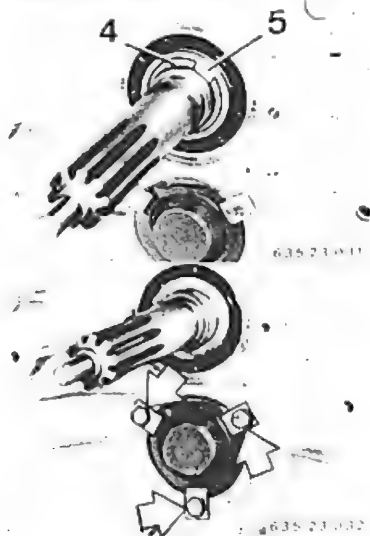
** Source of Supply: HWB



32 23 018



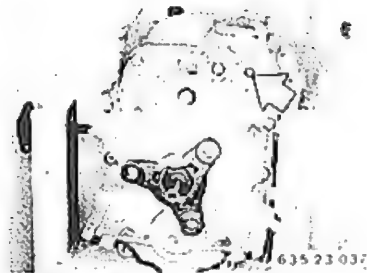
635 23 030



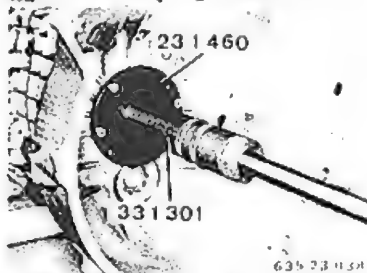
635 23 031

635 23 032

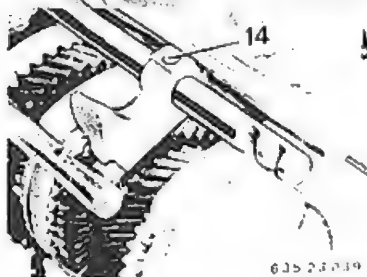
23-204



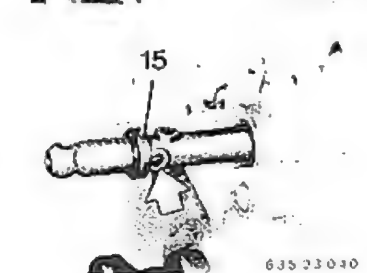
Knock back cylindrical pins.
Unscrew mounting bolts.



Pull off case front section with Special Tools 23 1 460 and 33 1 301.



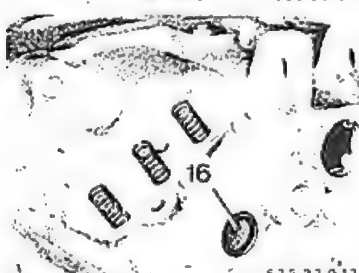
Fourth gear is engaged.
Drive pin (14) out of selector shaft (counterhold).



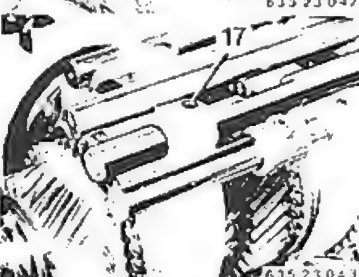
Drive out selector shaft toward rear.
Radial oil seal (15) will also be pulled out.
Important!
Needles on selector shaft.
Take off selector arm.
Installation:
Replace radial oil seal.



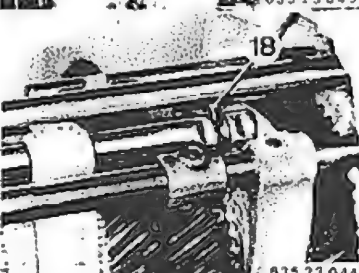
Remove end cap.
Installation:
Install end cap with sealing compound**.



Remove 3 springs.
Remove plug (16).
Installation:
Replace plug.



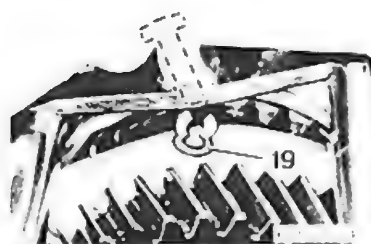
Take out fourth gear.
Drive pin (17) out of 3rd/4th gear selector rod (counterhold).



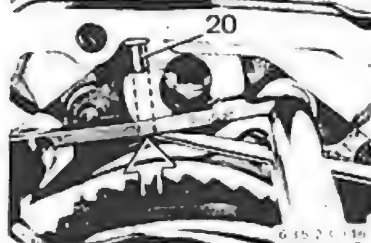
Knock out 3rd/4th gear selector rod toward front.
Important!
Lockpin (18).

** Source: HWB

23 - 205



Pull off retainer (19) on shaft bolt for operating lever.



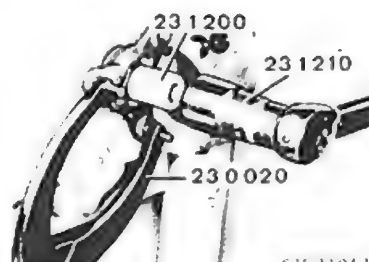
Push up shaft bolt (20).



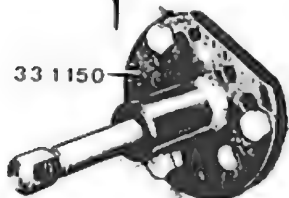
Pull out selector rail (21) forward.
Take off operating lever (22).
Installation
Mark on operating lever faces up.



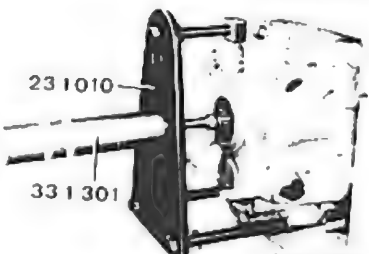
Unscrew bolt (23) for reverse gear shaft.
Installation
Install bolt with bolt cement**.



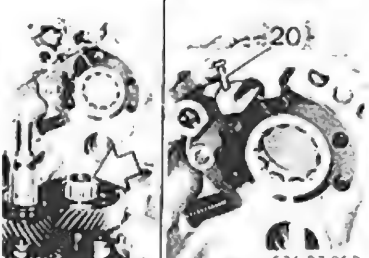
Lift out lockplate.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.



Pull off output flange with Special Tool 33 1 150.



Knock back dowel pins.
Pull off case rear section with Special Tools 23 1 010 and 33 1 301.



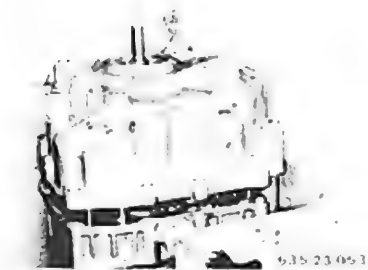
Coat sealing surface with sealing compound**. Sealing surface cleaned thoroughly and dried of oil.
Install roller bearing with small diameter of plastic cage facing up.
Important!
Shaft bolt (20) for operating lever must be installed and bearing inner race removed, by lifting out radial oil seal, before mounting case rear section.

** Source: HWB

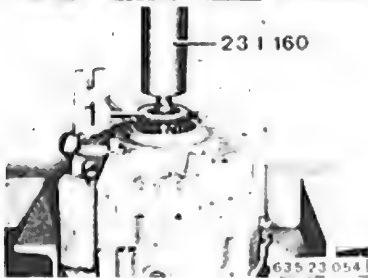
** Source: HWB

23-206

Mount rear case section.
Center 1st/2nd gear selector rod.
Drive in dowel pins.

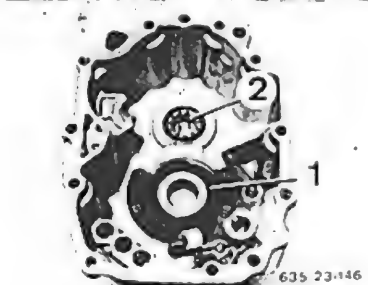


635 23 053

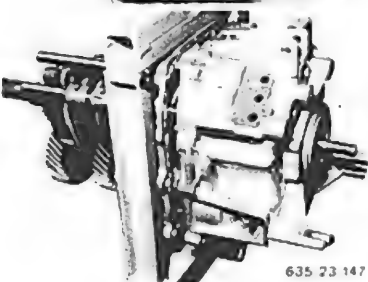


23 1 160

635 23 054



635 23 146



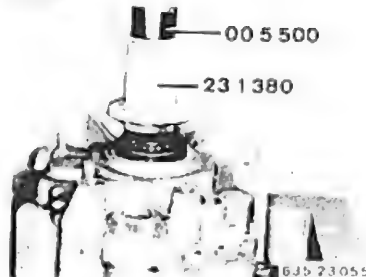
635 23 147

Heat bearing inner race (1) to about 80° C (175° F) with a hot air blower and install it on the output shaft, pressing it on with Special Tool 23 1 160 when necessary.

Version with Closed Bearing (1):
Install roller bearing (2) with the large diameter end facing up.
Hold rollers in position with grease.
Coat the sealing surface with a sealing compound**.
Sealing surface must be thoroughly cleaned and dried of oil.

Heat ball bearing inner race to about 80° C (175° F) with a hot air blower.
Mount rear case section in horizontal position of the gear wheel set.
Align 1st/2nd and 5th/reverse gear selector rods with the bores.
Mount cover up to the transfer case.
Turn the gear wheel set during this step to have roller bearing slide into the layshaft.
Drive in dowel pin.

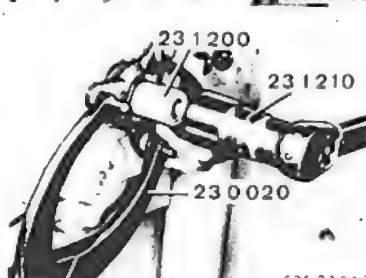
** Source of Supply: HWB



00 5 500

23 1 380

635 23 055

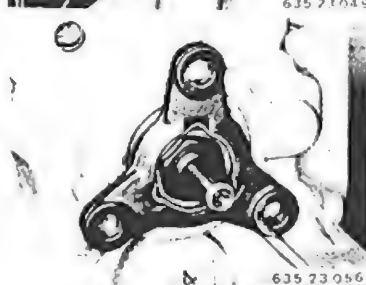


23 1 200

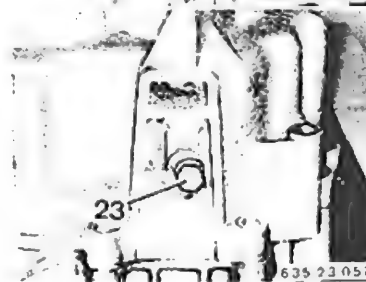
23 1 210

23 0 020

635 23 049



635 23 056



23

635 23 057

Drive in radial oil seal with Special Tools 23 1 380 and 00 5 500.
Lubricate sealing lip with oil.

Mount the output flange.
Install collar nut with a bolt cement**
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020 and tighten the collar nut with Special Tool 23 1 210.
Tightening torque*.

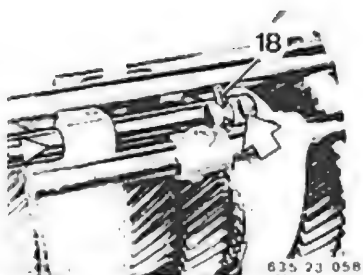
Install lockplate.

Install bolt (23) for the reverse gear shaft with a bolt cement** and tighten with correct torque*.

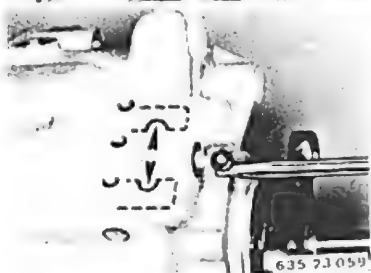
* See Specifications

** Source of Supply: HWB

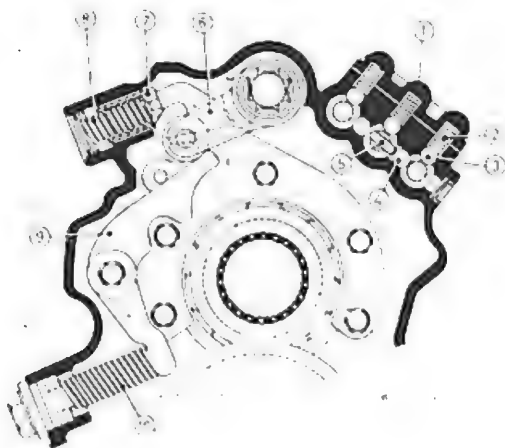
23-207



Push 3rd/4th gear selector rod through the selector fork.
Install lockpin (18) in the selector rod with grease.
Push in selector rod up to the bore.
Opening in selector rod faces up.



Install two locking balls with grease.
Push in 3rd/4th gear selector rod up to the arrest.



Arrest Layout:

- 1 End cap
- 2 Spring
- 3 Arresting ball
- 4 Locking ball
- 5 Lockpin
- 6 Selector arm
- 7 Lockpin
- 8 Spring
- 9 Locking lever
- 10 Spring

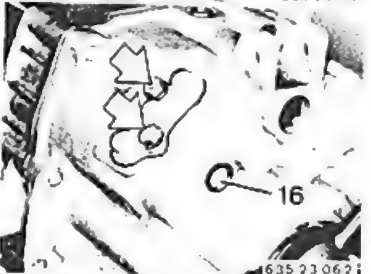


Drive 6 x 26 mm dowel pin into the 3rd/4th gear selector fork (counter-hold).

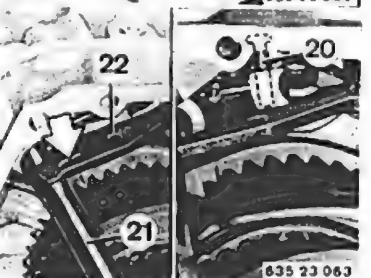


Insert three arresting balls and three springs.

Important!
Check length of spring.
Unstretched length of
springs (1) = 20 mm (0.787") and
spring (2) = 15 mm (0.630").



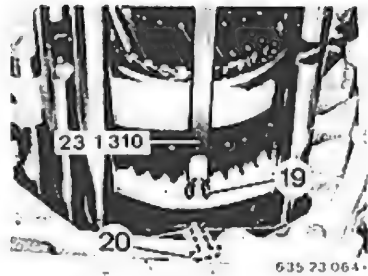
Coat end cap with a sealing compound** and tighten with correct torque*.
Install end cover (16) with a sealing compound**.



Install shift rail (21).
Push up shaft bolt (20) and install the reversing lever (22) with the mark facing up and toward the shift rail.

- * See Specifications
- ** Source of Supply: HWB

23-208



Set input shaft upright.
Push shaft bolt (20) in direction of the gear wheel set.
Install circlip (19) with Special Tool 23 1 310.

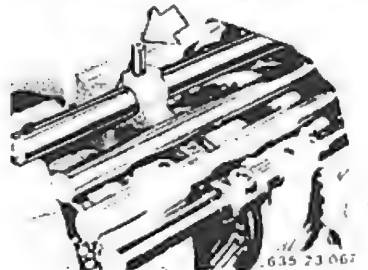


Hold the four rollers in position with grease.



Insert shift arm.
Push in shift shaft.

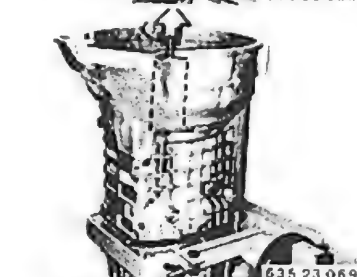
Important!
Opening in shift shaft faces shift rail (21).



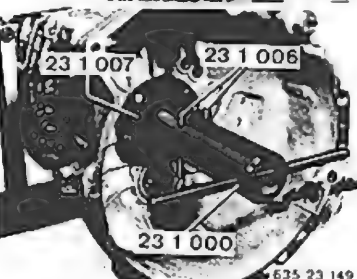
Drive in 6 x 26 mm dowel pin (counterhold).



Lubricate sealing lip of the radial oil seal with oil.
Drive in radial oil seal with Special Tool 23 1 240.



Coat sealing surface with a sealing compound**.
Sealing surface must be thoroughly cleaned and dried of oil.
Heat bearing inner race for input shaft to about 80° C (175° F) with a hot air blower.
Mount front case section while pulling out the input shaft.
Tighten front case section with correct torque*.

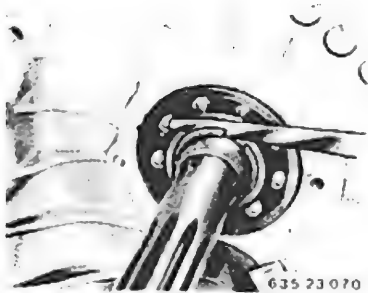


Version with Closed Bearing:
Coat sealing surface with a sealing compound**.
Sealing surface must be thoroughly cleaned and dried of oil.
Heat ball bearing inner race to about 80° C (175° F) with a hot air blower.
Mount case as far as possible.
Mount Special Tool 23 1 007 on the front case section.
Press grooved ball bearing on the input shaft or front case section on the gear wheel set with Special Tools 23 1 000 and 23 1 006.

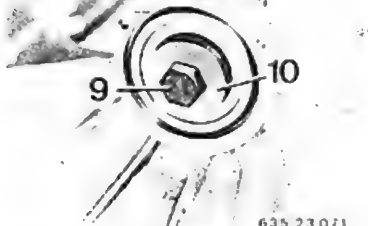
Important!
Apply Special Tools 23 1 006 (dowel pins) that the flattened ends face the input shaft.

* See Specifications
** Source of Supply: HWB

23-209



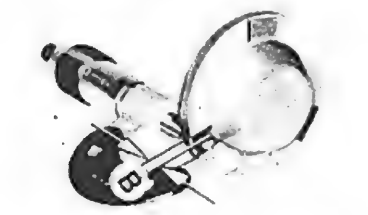
Install shim and circlip.
Reduce any play between the bearing inner race and circlip to 0 ... 0.09 mm (0 to 0.0035").



Engage 4th gear.
Install washer (10) and bolt (9).
Install bolt with a bolt cement**.
Tighten bolt (9) with correct torque* while holding the output flange with Special Tool 23 0 020.



Determine thickness of shim between the bearing outer race of the layshaft and sealing cover.
Measure distance (A) from bearing outer race to case opening for the mounting tabs.

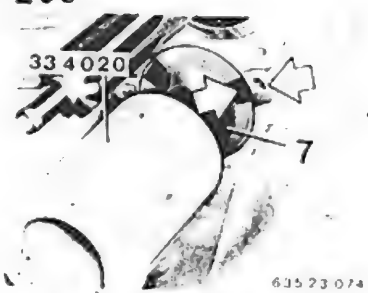


Measure wall thickness (B) of the sealing cover, measuring on the recess for the mounting tab.

Example:

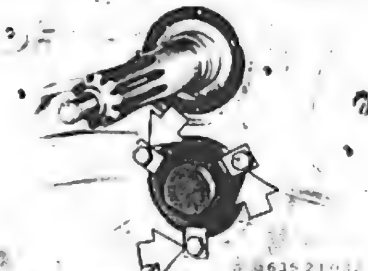
A = 1.4 mm (0.055")
- B = 0.9 mm (0.035")
0.5 mm (0.020") thick shim

* See Specifications
** Source of Supply: HWB

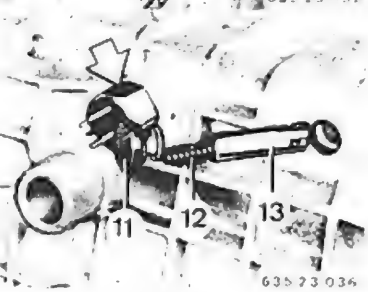


Hold shim of determined thickness in position with grease.
Drive in sealing cover (7) to fit tight with Special Tool 33 4 020.

Important!
Install sealing cover that recesses on the sealing cover are aligned with openings on the case.



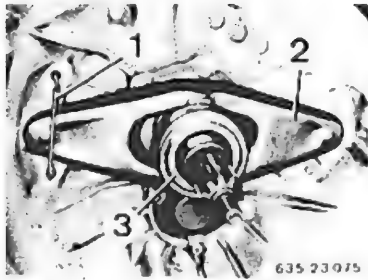
Tighten tabs with correct torque*.
Install bolts with a bolt cement**.



Install lockpin (13), spring (12) and cover (11).
Check installed position of the lockpin.

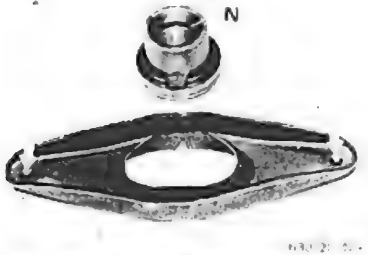
* See Specifications
** Source of Supply: HWB

23-210



23 11 622 REMOVING AND INSTALLING GUIDE SLEEVE FOR CLUTCH RELEASE - Transmission Removed -

Lift out spring (1) and remove release lever (2) with thrust bearing (3).



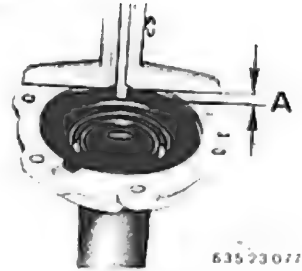
Installation:
Fill lubricating groove N with Molykote Longterm 2.
Coat guides F and bearings L with Molykote Longterm 2.
Non-conformance could cause seizure of the release bearing on the guide sleeve.

Important!!
Use Microlube 261** on version with a double-mass flywheel.

Unscrew guide sleeve.

Important!!
Shims.

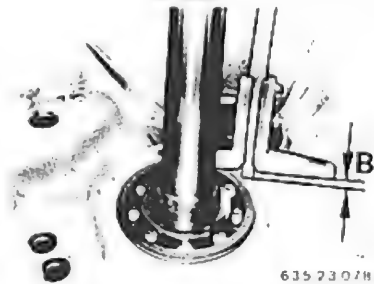
Installation:
Mount guide sleeve that oil groove (1) is aligned with oil bore (2) in transmission case or arrow on face points to middle of the layshaft.
Install guide sleeve and bolts with a sealing compound**.
Sealing surface and bolts must be cleaned thoroughly and dried of oil.
Tightening torque*.



Installation:
Eliminate any play.
Max. axial preload on bearing outer race = 0.1 mm (0.004").
Determine thickness of shim.
Measure distance (A).

Measure distance (B).

Example:
A = 3.0 mm (0.118")
- B = 2.5 mm (0.102")
0.4 mm (0.016") thick shim



* See Specifications
** Source of Supply: HWB

23 - 211

23 12 502 REPLACING RADIAL OIL SEAL FOR INPUT SHAFT -TRANSMISSION REMOVED-

Remove guide sleeve 23 11 622.
Lift out radial oil seal.

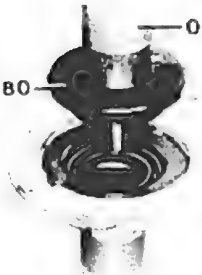


635 23 148

00 5 500

Drive in radial oil seal with Special Tools
23 1 180 and 00 5 500.
Open end faces up.
Lubricate sealing lip with oil.

23 1 180



635 23 028

23 - 212

23 21 501 REMOVING AND INSTALLING INPUT/OUTPUT SHAFT ASSY. -CASE FRONT AND REAR SECTIONS REMOVED-

Clamp Special Tool 23 0 080 in a vise.
Take intermediate case with gear set off of
Special Tool 23 0 030 and mount on
Special Tool 23 0 080.
Pull off 5th gear.
Pulling off force*.

Caution!
To avoid damaging the 3rd gear when pulling
off 5th gear, make sure that play (S) is
always provided between 3rd gear and
layshaft.
Push up output shaft if necessary.

Take up intermediate case with gear set in
Special Tool 23 0 030 again.
Pull bearing inner race off of output shaft
with Special Tools 23 1 100 and 00 7 500.
Machine pulling hooks accordingly to fit
in slots.

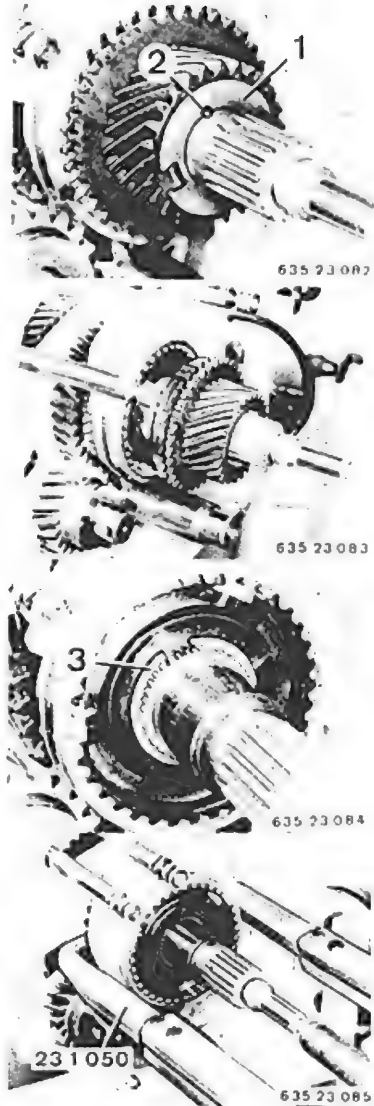
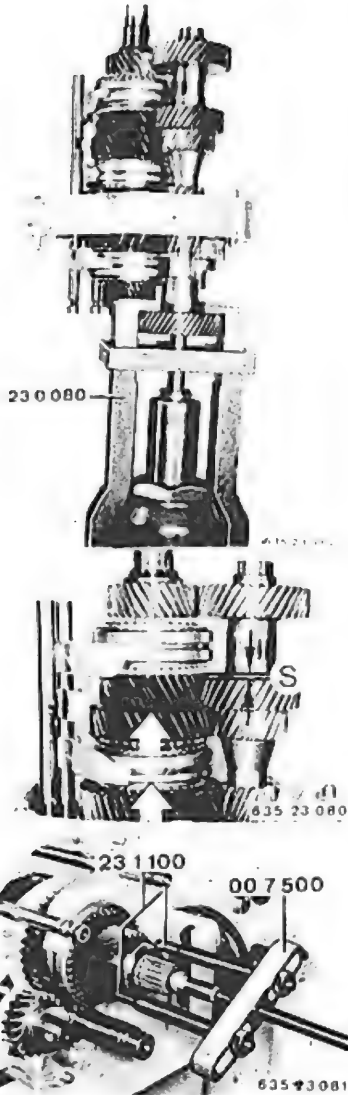
* See Specifications

Take off washer (1) and ball (2).

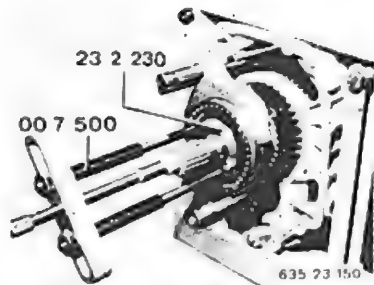
Pull off 5th gear with synchromesh ring and
split needle bearing.

Remove circlip (3).
Installation:
Replace circlip.

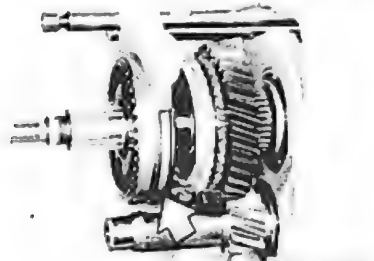
Pull off reverse gear with operating rod and
guide sleeve, with Special Tool 23 1 050.



23-213

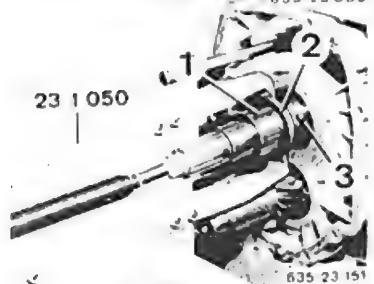


For the version with a pre-tensioned toothed washer on the gear wheel the guide sleeve must be pulled off of the output shaft with help of Special Tool 23 2 230 used together with Special Tool 00 7 500 (Kukko).

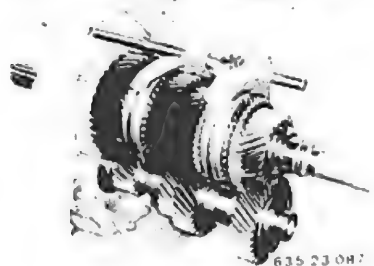


Take guide sleeve with shift fork and shift rod, synchromesh ring, reverse gear and needle bearing off of the output shaft.

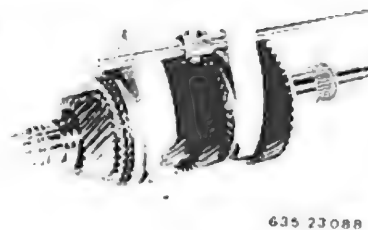
Important!
Installation:
Shouldered end of operating sleeve must face the reverse gear.



Version with Bearing Sleeve:
Drive output shaft forward with light knocks from a plastic hammer until the pulling-off claws can be applied. Pull bearing sleeve (1) and thrust washer (2) off of the output shaft using Special Tool 23 1 050 (Kukko). Remove ball (3).

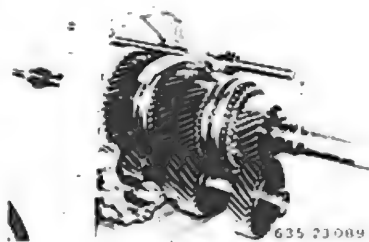


Pull input shaft, output shaft with 1st/2nd gear shift rod, 3rd/4th gear shift fork and layshaft out of the intermediate case.

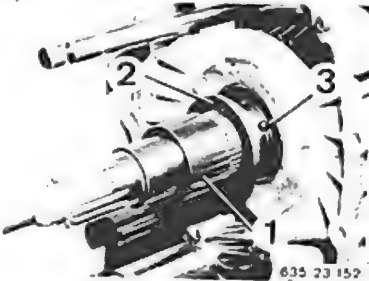


Take shift rod with 1st/2nd gear shift fork and 3rd/4th gear shift fork off of the gear set assembly.

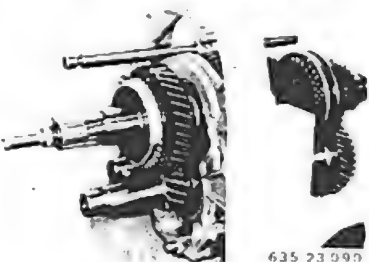
Installation:
Insert input shaft, output shaft with 1st/2nd gear shift rod and layshaft into the intermediate case.



Version with Bearing Sleeve:
Insert ball (3) and push thrust washer (2) on. Heat bearing sleeve (1) to about 80° C with a hot air blower and push on to the output shaft.



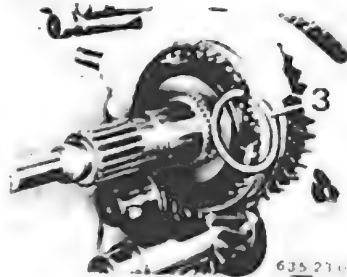
Install needle bearing, reverse gear and synchromesh ring on the output shaft.



23-214

Version with Tensioned Tooth Rings:
Install needle bearing and reverse gear wheel.

Push on intermediate wheel (1) up to the tooth ring.
Turn tooth ring on intermediate wheel until the teeth of the intermediate gear wheel and layshaft mesh.



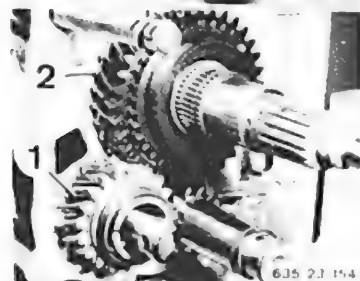
Move operating sleeve in direction of the reverse gear wheel.

Adjust guide sleeve free of play with circclip (3).

Circclips are available from Parts in different thicknesses from 1.7 to 2.0 mm (0.067 to 0.079"). Install circclip (3).



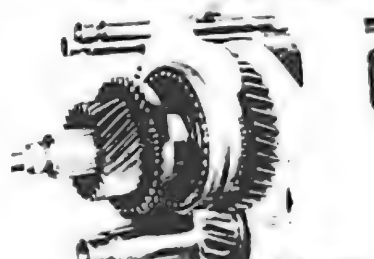
635 23 153



635 23 154

Push on intermediate gear wheel in this position up to the tooth ring of the gear wheel.

Turn tooth ring (2) on the gear wheel until the teeth of the gear wheel and intermediate gear wheel (1) mesh. Mount intermediate gear wheel against the bearing surface.

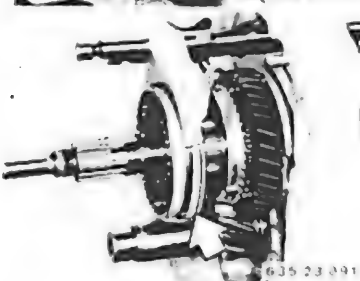


635 23 154

Install guide sleeve with operating sleeve and selector rod with 5th/ reverse gear selector fork on the output shaft.

Important!

Stepped end of the operating sleeve must face the reverse gear wheel.

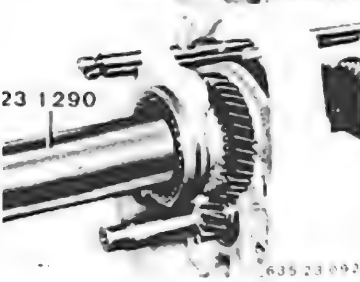


635 23 091

Drive on guide sleeve by applying light knocks with Special Tool 23 1 290.

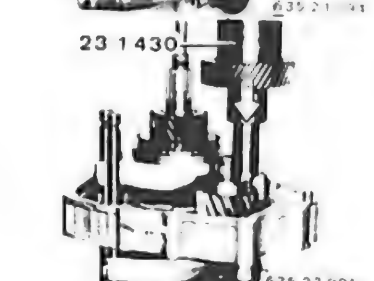
Important!

Tabs on synchromesh ring must be aligned with openings of guide sleeve.



635 23 092

23 1 430



635 23 095

Take transfer case with gear wheel set off of Special Tool 23 0 030 and set up in a press.

Lubricate pressing surface of the layshaft with oil.

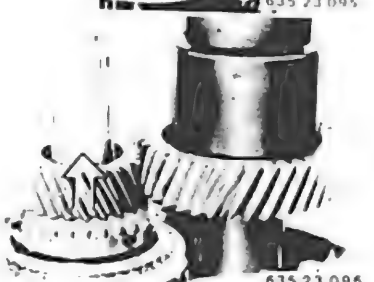
Heat 5th gear wheel uniformly to 150° C (300° F), checking temperature with a thermocolor crayon.

Install 5th gear wheel on the layshaft and press on to fit tight with Special Tool 23 1 430.

Pressing-on force*.

Important!

Lift and turn the 5th gear wheel until the teeth mesh.



635 23 096

* See Specifications

23- 214 a

**Install split needle bearing.
Insert ball (2) with grease.
Push on washer (1).**

Note:

A transmission with code OH does not have a ball.



635 23 042

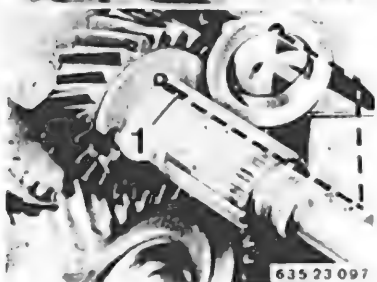
Installation:

Heat ball bearing inner race to about 80° C (175° F) with a hot air blower and push it on the output shaft.

Important!

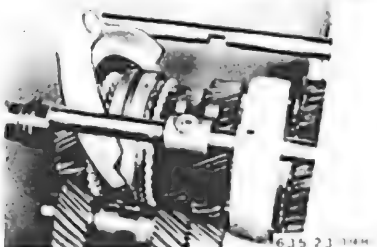
Turning lock:

Opening on bearing inner race must engage on ball.
Draw line (1) to make installation of the bearing race easier.



635 23 097

Mount 3rd/4th gear selector fork.



635 23 114M

23-215

23 21 552 REPLACING OUTPUT SHAFT - Output Shaft Removed -

Pull off Input shaft (1), synchromesh ring (2) and needle bearing (3).

Note:
To avoid mixing up synchromesh rings while disassembling the output shaft, it is recommended to mark synchromesh rings for pertinent gear wheels.

Lift out circlip (4).
Take off shim (5).

Press off 3rd gear wheel with guide and operating sleeves with Special Tool 23 1 490.
Take off needle bearing.
Pressing-off force*.

Lift out circlip (6).

Installation:
Replace circlip.

* See Specifications

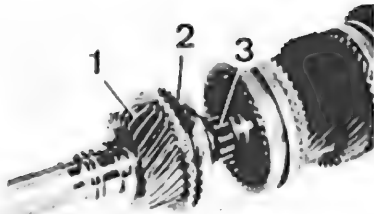
Version with Bearing Sleeve:
Press 2nd gear wheel with bearing sleeve (1) and thrust washer (2) off of the output shaft with Special Tool 23 1 490.

Take off ball (3), needle bearing and 2nd gear synchromesh ring.
Lift out circlip (4).

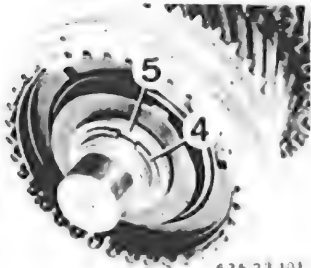
Installation:
Replace circlip.

Press guide and operating sleeves for 1st /2nd gears with 1st gear wheel off of the output shaft.
Take off needle bearing.

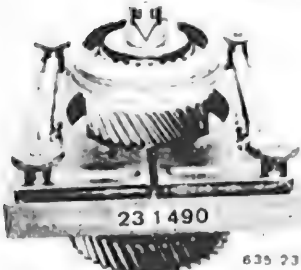
Press 2nd gear wheel, guide sleeve and 1st gear wheel off of the output shaft.



635 23 100



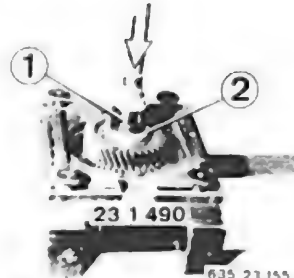
635 23 101



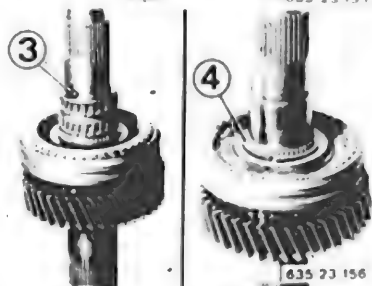
635 23 102



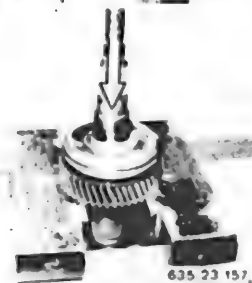
635 23 103



635 23 155



635 23 156

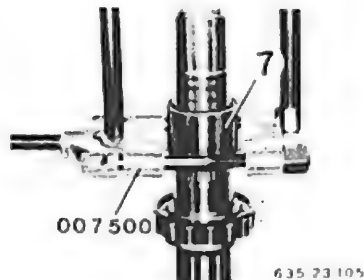


635 23 157

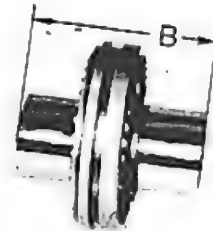


635 23 104

23-216



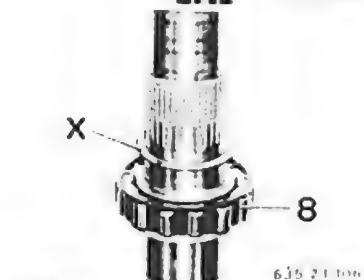
Pull collar (7) off of the output shaft with Special Tool 00 7 500.



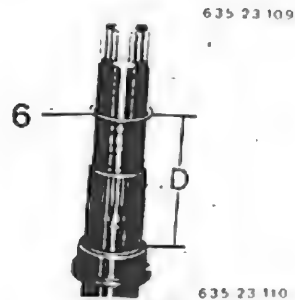
Assemble 1st gear collar, 1st/2nd gear guide sleeve and 2nd gear collar. Measure distance (B). For example: 93.1 mm (3.665").

Example:

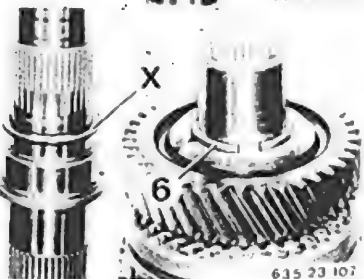
A = 128.3 mm (5.051")
 - B = 93.1 mm (3.665")
 = 35.2 mm (1.386")
 - C = 34.7 mm (1.366") adjustment
 X = 0.5 mm (0.020") thick shim



Take off shim (X) and roller bearing (8).



Determine thickness of circlip (6). Install old circlip in groove. Measure distance (D) from bearing surface of 1st gear collar to lower edge of circlip. Circlip must be pressed firmly in the groove while measuring. For example: 93.6 mm (3.685").



Measure thickness (E) of the circlip. For example: 1.9 mm (0.075").

Example:

D = 93.4 mm (3.677")
 + E = 1.9 mm (0.075")
 F = 95.3 mm (3.752")

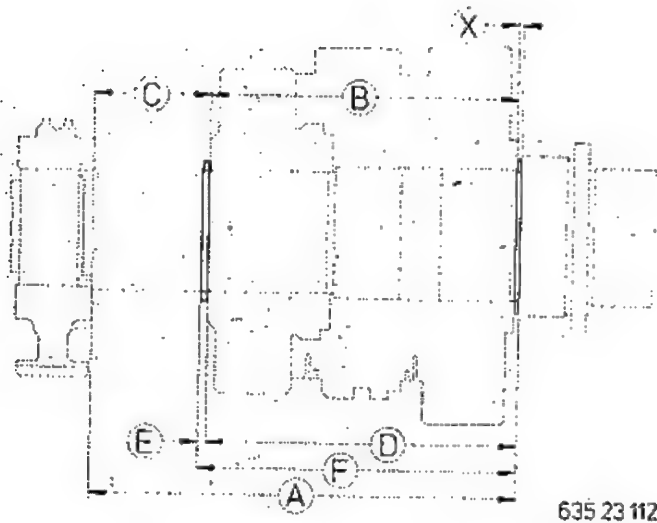
Important!
 Determine thickness of shim (X) and circlip (6) before reinstalling the gear wheel set. Shims are available in thicknesses from 0.3 to 0.5 mm (0.012 to 0.020") and circlips from 1.7 to 1.9 mm (0.067 to 0.075") from Parts.

Determine thickness of shim X. Measure distance (A) from collar of 3rd/4th gear guide sleeve to bearing surface of 1st gear collar. For example: 128.3 mm (5.051").



635 23 108

23-217



Beispiel:
 Exempel: 1 mm
 B = 93.7 mm (3.685")
 + X = 0.5 mm (0.020")
 G = 93.998 mm (3.685")
 F = 95.353 mm (3.752")
 G = 93.998 mm (3.685")
 E = 1.7 mm (0.067") thick circlip
 E = 1.7 mm Sicherungsring



Install roller bearing (9) with the small diameter end of the plastic cage facing the collar. Install shim (X) of determined thickness.

Heat collar (7) to about 80° C (175° F) with a hot air blower. Install collar.

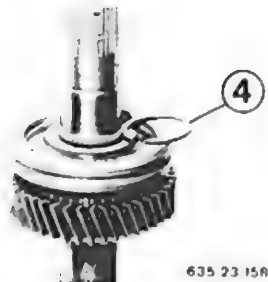
Install needle bearing, 1st gear wheel and synchromesh ring on the output shaft.

Install 1st/2nd gear guide sleeve with the stepped end of the operating sleeve facing the 1st gear wheel. Version with Groove: Groove faces 2nd gear wheel. Press on guide sleeve to fit tight with Special Tool 23 1 290. Pressing-on force*.

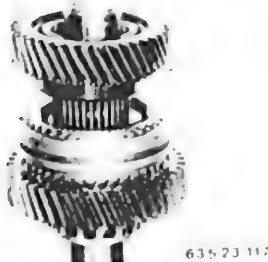
Important!
 Make sure tabs on synchromesh ring are aligned with opening in guide sleeve while pressing on.

* See Specifications

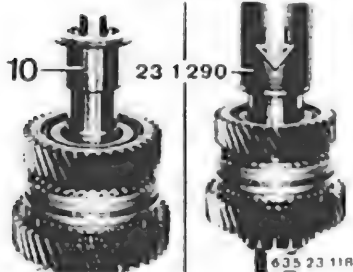
23-218



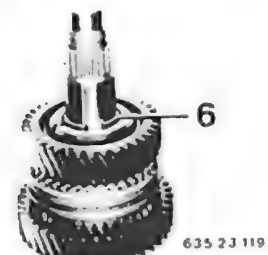
Install circlip (4) if still available. Play of the guide sleeve must be eliminated with the circlip. Circlips are available from Parts in different thicknesses from 1.7 to 1.95 mm (0.067 to 0.077").



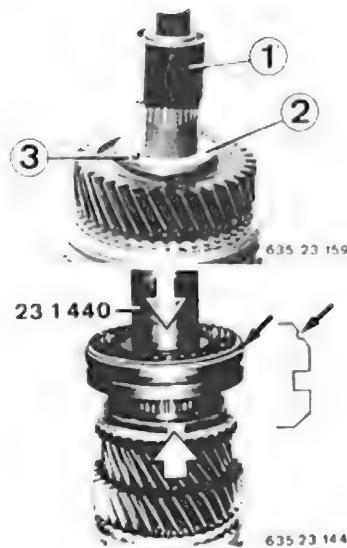
Install synchronesh ring, needle bearing and 2nd gear wheel.



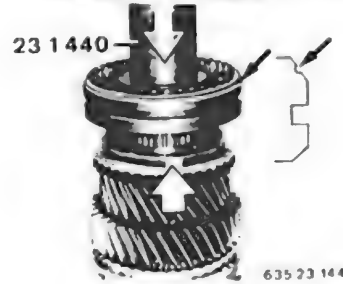
Heat collar (10) to about 80° C (175° F) with a hot air blower and install it on the output shaft, pressing it on to fit tight with Special Tool 23 1 290 when necessary. Turn the 2nd gear wheel to prevent seizure of the needle bearing.



Install circlip (6) of determined thickness.



Install ball (3) and thrust washer (2). Heat bearing sleeve (1) to about 80° C (175° F) with a hot air blower and install it on the output shaft.

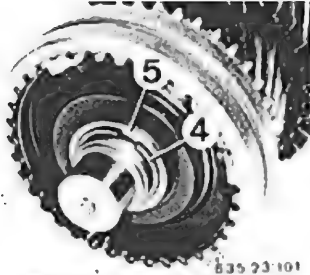


Install needle bearing, 3rd gear wheel and synchronesh ring. Install 3rd/4th gear guide sleeve with the stepped end facing the 3rd gear wheel and press on with Special Tool 23 1 440.

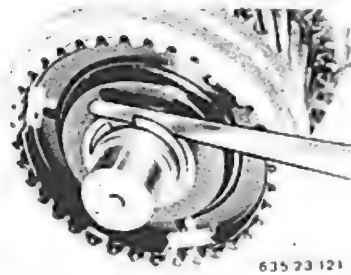
Version with Groove:
Groove faces the 4th gear wheel.

Important!
Tabs on the synchronesh ring must be aligned with openings in the guide sleeve.

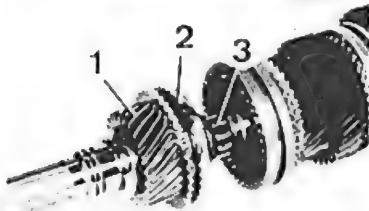
23-218a



Install shim (5) and circlip (4).



Installation:
Reduce play between the circlip and g
sleeve to 0 ... 0.09 (0 ... 0.0035").

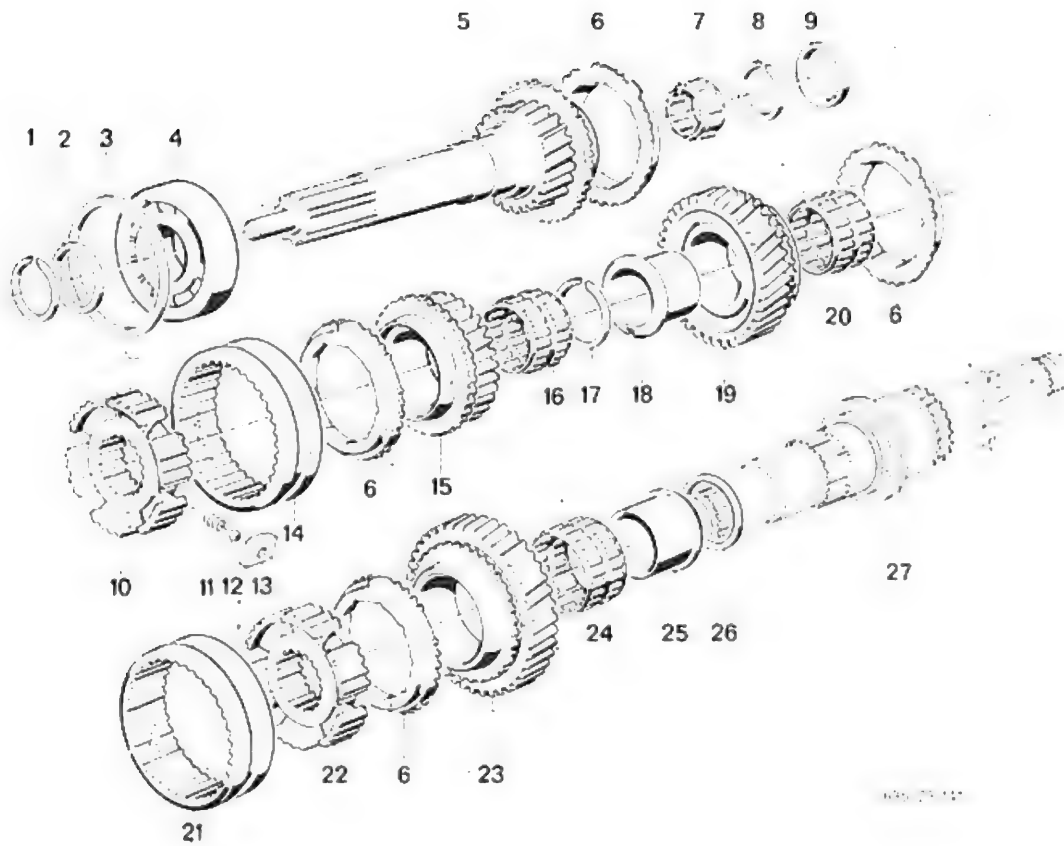


Install needle bearing (3), synchromesh ring (2)
and input shaft (1).

435 23 100

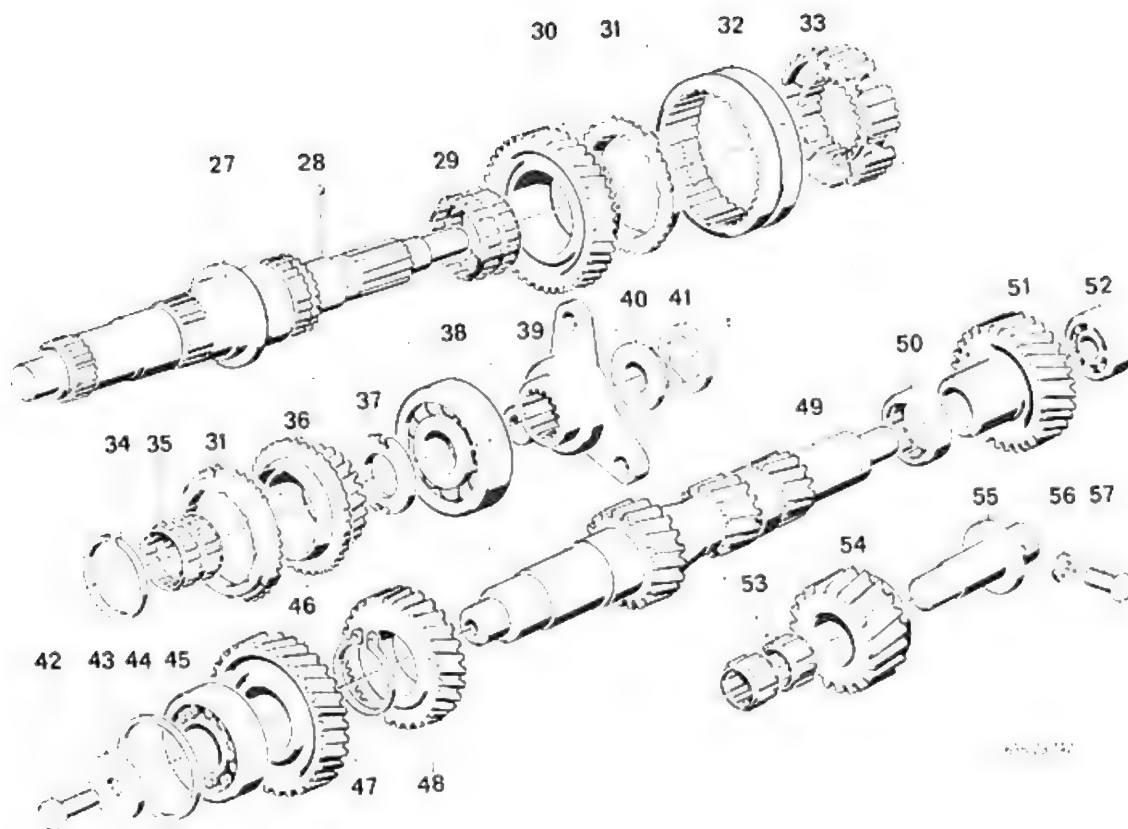
23-219

Layout of Gears and Bearings



23 - 219_a

Layout of Gears and Bearings



- 27 Output shaft
- 28 Ball
- 29 Needle bearing
- 30 Reverse gear wheel
- 31 Synchromesh ring
- 32 Operating sleeve
- 33 Guide sleeve
- 34 Circlip
- 35 Needle bearing
- 36 5th gear wheel
- 37 Thrust washer
- 38 Ball bearing
- 39 Output flange
- 40 Collar nut
- 41 Lockplate
- 42 Bolt
- 43 Washer
- 44 Spacer
- 45 Ball bearing
- 46 4th gear wheel
- 47 Circlip
- 48 3rd gear wheel
- 49 Layshaft
- 50 Roller bearing
- 51 5th gear wheel
- 52 Roller bearing
- 53 Needle bearing
- 54 Reverse gear
- 55 Shaft
- 56 Washer
- 57 Bolt

61-12-12

23 - 220

23 21 702 REPLACING BEARINGS OF ALL TRANSMISSION SHAFTS - TRANSMISSION REMOVED -

A) Input Shaft, Layshaft in Case Front Section:
Remove case front and rear sections 23 11 006.
Remove input/output shaft assy. 23 21 501.
Drive out bearing with Special Tools
23 1 180 and 00 5 500.

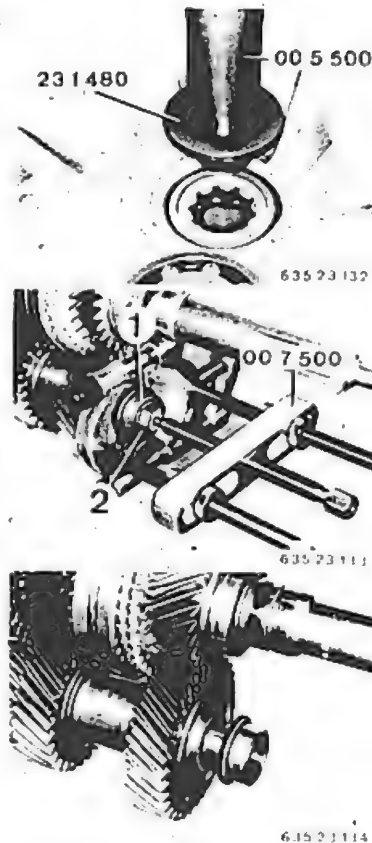
Heat case front section in area of bearing to
approx. 80° C (175° F) with a hot air blower.
Important!
Install bearing with rollers facing gear set,
driving in to fit tight with Special Tools
23 1 470 and 00 5 500 if necessary.

Layshaft:
Drive out roller bearing with Special Tools
23 1 390 and 00 5 500.

Heat case front section in area of bearing to
approx. 80° C (175° F) with a hot air blower.
Drive in roller bearing with Special Tools
23 1 480 and 00 5 500.
Determine thickness of spacer between bearing
outer race and sealing cover (see 23 11 006).

Pull bearing inner race (1) off of layshaft with
Special Tool 00 7 500.
Caution!
Bolt (2) must be screwed in tapped bore to
avoid damage on threads.

Heat new bearing inner race to approx. 80° C
(175° F) with a hot air blower and install on
layshaft.
If necessary, drive on to fit tight with Special
Tool 23 1 160.



23-221

B) Output Shaft, Layshaft in Case Rear Section:

Output Shaft:
Unscrew bolt (1).

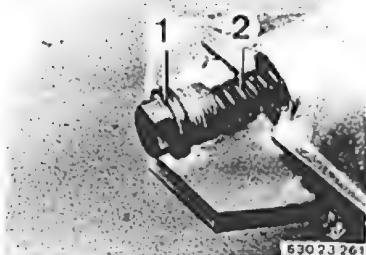
Caution!

Spring force:

Remove spring (2).

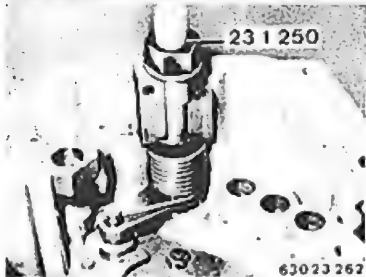
Installation:

Install bolt with bolt cement**.



630 23 261

Install Special Tool 23 1 250 to remove the selector arm.



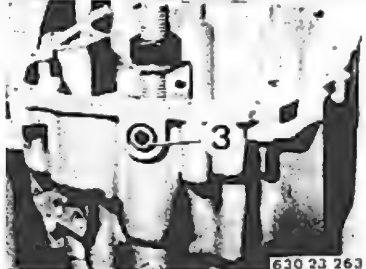
630 23 262

Remove socket head screw (3).

Installation:

Install screw with bolt cement**.

Tightening torque*.

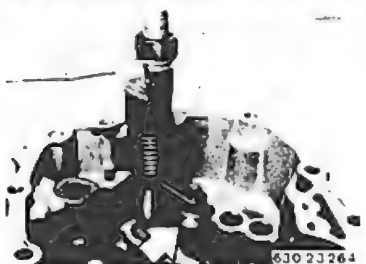


630 23 263

Remove selector arm from above.

Important!

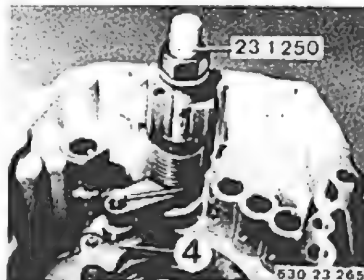
Roller.



630 23 264

* See Specifications

** Source: HWB

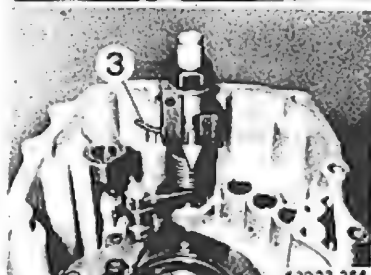


23 1 250

630 23 265

Installation:

Insert selector arm with Special Tool 23 1 250. Swing out selector arm with roller above locking lever (4).



630 23 266

Move end of spring (3) over boss into installed position.

Push down (do not knock down) selector arm in this position.

Mount selector arm with socket head screw before removing special tool.

Install bolt with bolt cement**.

Tightening torque*.



630 23 267

Remove bearing holder (5).

Important!

Don't unscrew bolt (6).

Locking lever (7) remains on bearing holder.



630 23 268

Installation:

Check installed position of locking lever (7) and thrust pin (8).

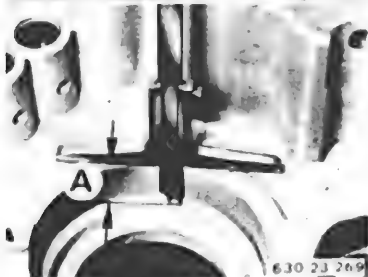
* See Specifications

** Source: HWB

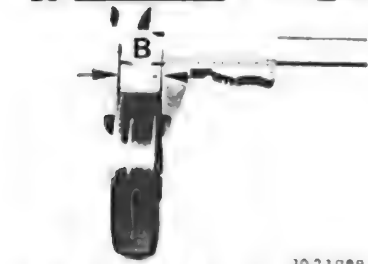
23-222



Lift out radial oil seal.
Drive out grooved ball bearing with Special Tools 23 1 120 and 00 5 500.
Important!
Spacer (D).



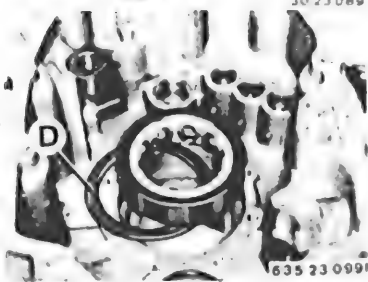
Determine thickness of spacer (D).
Measure distance (A).



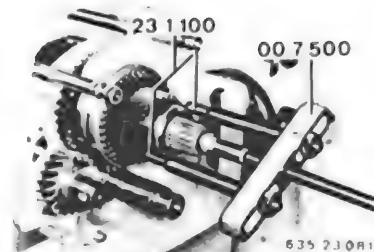
Measure distance (B).

Example:

A	20.3 mm (0.799")
- B	20.0 mm (0.787")
D	0.3 mm (0.012") spacer thickn.



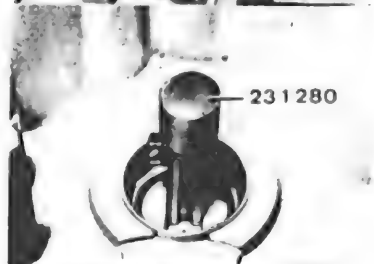
Heat case rear section in area of grooved ball bearing to approx. 80° C (175° F).
Insert spacer (D).
Install grooved ball bearing.
If necessary, drive in bearing against stop with Special Tool 23 1 470.



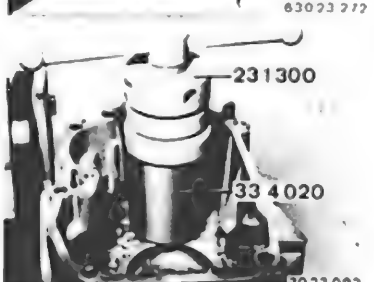
Pull bearing inner race off of output shaft with Special Tools 23 1 100 and 00 7 500.
Machine Special Tools 23 1 100 accordingly to fit in slots.



Heat ball bearing inner race to approx. 80° C (175° F) with a hot air blower and install on output shaft.
Important!
Turning lock.
Opening in bearing inner race must engage in ball.
Draw line (1) to make installation of bearing race easier.



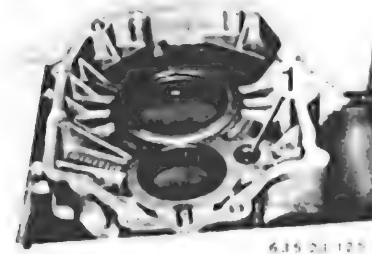
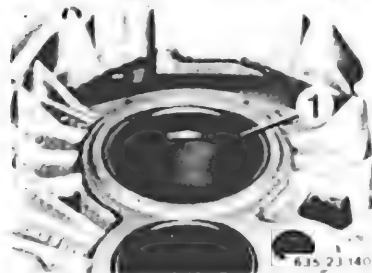
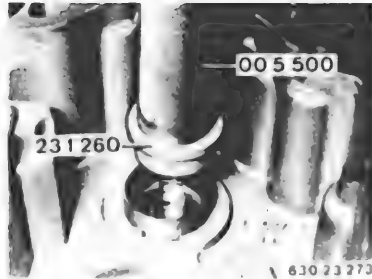
Layshaft:
Insert Special Tool 23 1 280 in bearing shell.



Apply Special Tool 33 4 020.
Screw on Special Tool 23 1 300.
Pull out bearing shell.

23-223

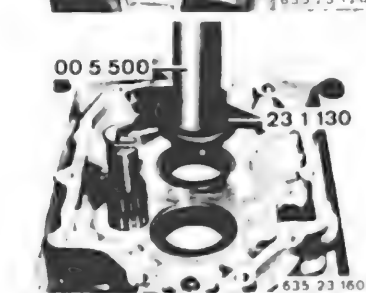
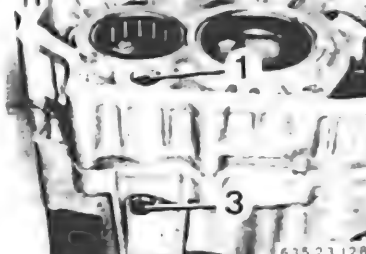
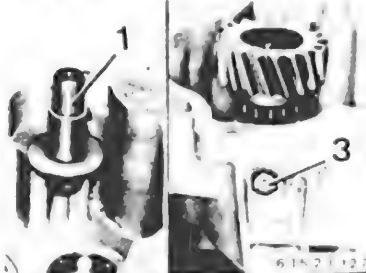
Drive in bearing shell with Special Tools 23 1 260 and 00 5 500.



C) Output Shaft, Layshaft, Reverse Gear Wheel in Transfer Case

Output Shaft:
Check whether bearing outer race (1) can be reused.
The bearing outer race can be replaced only together with the complete transfer case.
Replacing the roller bearing on the output shaft requires removal of the output shaft – see 23 21 552.

The reverse gear wheel shaft must be removed for removal of the roller bearing of the layshaft.
Press or drive out reverse gear wheel shaft (1).



Drive out (and in) roller bearing (2) with Special Tools 23 1 130 and 00 5 500.
The roller bearing must be flush.

Mount reverse gear shaft (1) on the rear case section with bolt (3).
Install needle bearing and reverse gear wheel.

Take transfer case off of Special Tool 23 0 030.
Heat bore for reverse gear wheel shaft to about 80° C (175° F) with a hot air blower.
Place transfer case on reverse gear wheel shaft (1) and center the bores of the case bolts.
Unscrew bolt (3) and take the transfer case off of the rear case section.

Version with Two Roller Bearings in Transfer Case:
Drive out (and in) both roller bearings with Special Tools 23 1 130 and 00 5 500.
The circlip must be removed for replacement of the needle bearing for the reverse gear wheel.

23-224

23 23 504 DISASSEMBLING AND ASSEMBLING COMPLETE SYNCHRONIZATION - Output Shaft Removed -

Disassemble output shaft - see
23 21 552.

All synchromesh rings are identical
and have a molybdenum coat on the
inside.

Check distance* between the synchro-
mesh ring and clutch body.

Measure in the area of the stops.

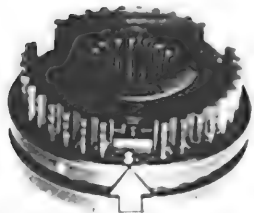
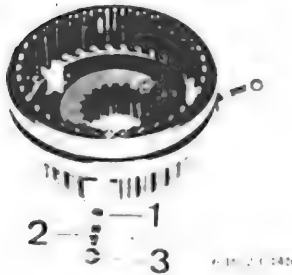
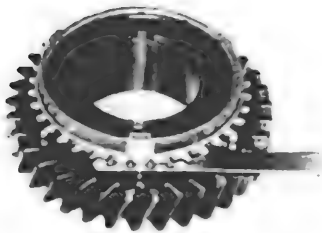
Synchromesh rings should bear uni-
formly all around on the entire surface.

Disassemble synchronizer.

Thrust piece (1)

Spring (2)

Ball (3)



Installation:

Install all springs, thrust pieces and
balls.

Important!

Domed surface of thrust pieces (2)
faces the shifting sleeve.

Insert synchronizer in the operating
sleeve half its distance.

Press in balls so far that the synchro-
nizer can be pressed into the operating
sleeve.

* See Specifications

Construction group 23 Manual transmission

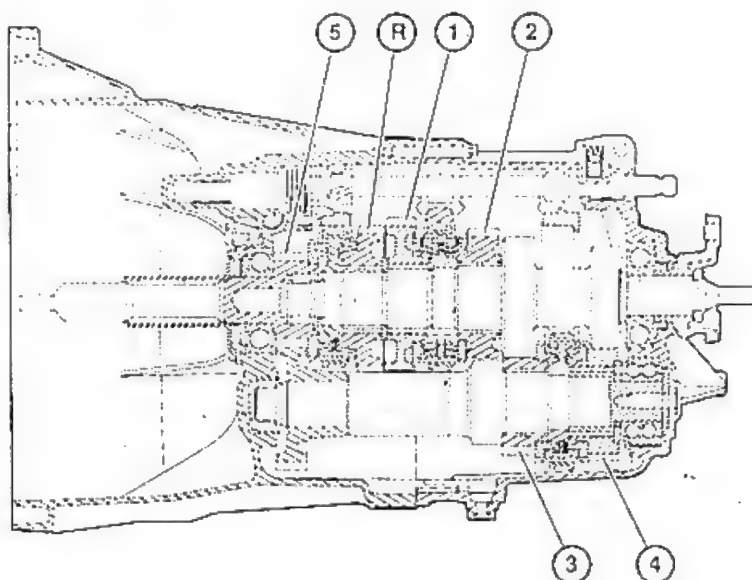
Five speed transmission – type GS5 D 310/4.20 Z (S5-31)

	Transmission – layout drawing	23- 400
	Front and rear case sections – layout drawing	23- 401
	Gears and shafts – layout drawing	23- 402
	Shift elements – layout drawing	23- 403
23 12 505	Radial oil seal for input shaft – replace	23- 404
23 21 502	Input and output shaft assembly – remove and install	23- 405
705	Bearings of all transmission shafts – replace	23- 414
23 23 507	Synchronization – disassemble and assemble	23- 416

23-400

Cross Section Drawing View of Type
GS 5 D 310/4.20 Z (S 5-31) Transmission

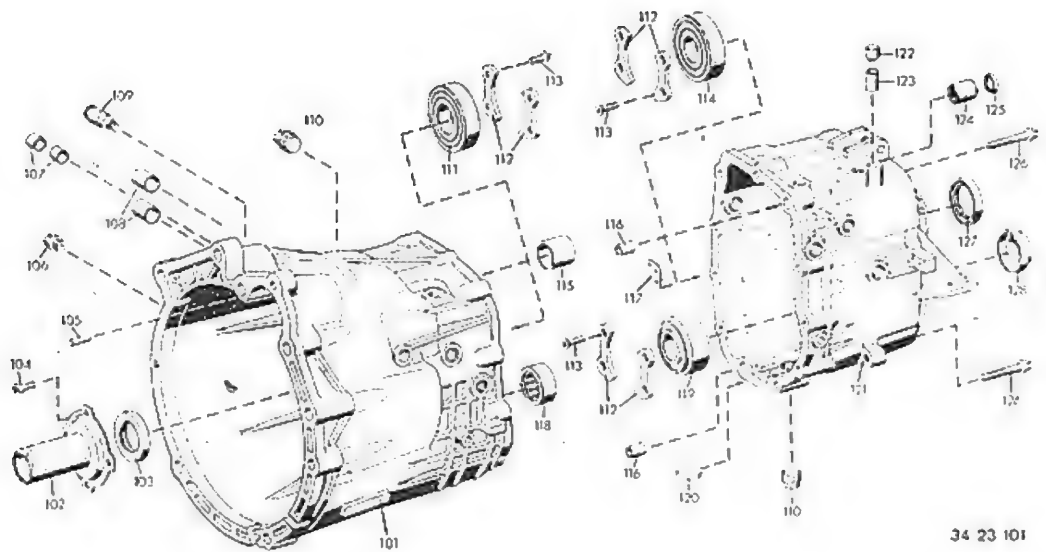
- 1 First gear
- 2 Second gear
- 3 Third gear
- 4 Fourth gear
- R Reverse gear



24-25-100

23-401

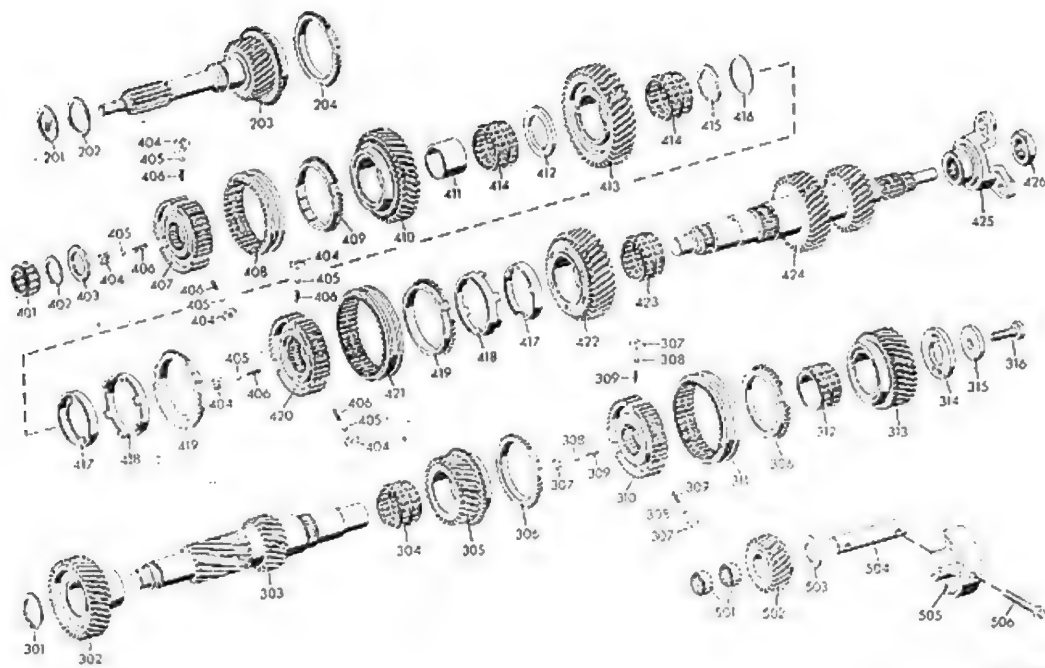
Drawing of Front and Rear Case Sections



- 101 Front case section
- 102 Guide tube
- 103 Radial oil seal
- 104 Bolts
- 105 Dowel pin
- 106 Plug
- 107 Plain bearing
- 108 Plain bearing
- 109 Shaft
- 110 Plug
- 111 Ball bearing
- 112 Element
- 113 Bolts
- 114 Ball bearing
- 115 Plain bearing
- 116 Sleeves
- 117 Plate
- 118 Needle bearing
- 119 Ball bearing
- 120 Magnet
- 121 Rear case section
- 122 Cap
- 123 Sleeve
- 124 Ball sleeve
- 125 Radial oil seal
- 126 Bolts
- 127 Radial oil seal
- 128 Cover

34 23 101

23-402

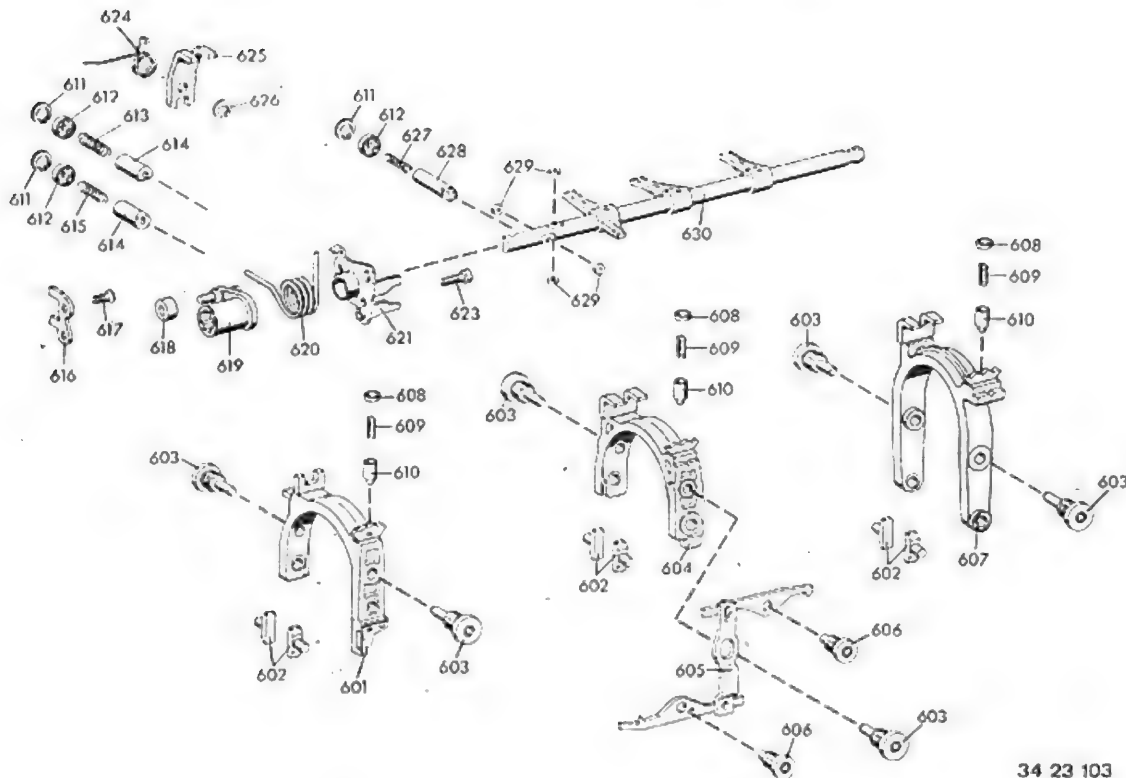


34 23 102

Drawing of Gears and Shafts

- 201 Circlip
- 202 Spacer
- 203 Input shaft
- 204 Synchronmesh ring
- 301 Circlip
- 302 5th gear
- 303 Layshaft
- 304 Needle bearing
- 305 3rd gear
- 306 Synchronmesh ring
- 307 Thrust piece
- 308 Ball
- 309 Spring
- 310 Guide sleeve
- 311 Operating sleeve
- 312 Needle bearing
- 313 4th gear
- 314 Thrust washer
- 315 Washer
- 316 Bolt
- 401 Grooved ball bearing
- 402 Circlip
- 403 Spacer
- 404 Thrust piece
- 405 Ball
- 406 Spring
- 407 Guide sleeve
- 408 Operating sleeve
- 409 Synchronmesh ring
- 410 Reverse gear
- 411 Bearing sleeve
- 412 Washer
- 413 1st gear
- 414 Needle bearing
- 415 Circlip
- 416 Spacer
- 417 Inner race
- 418 Intermediate rin,
- 419 Outer race
- 420 Guide sleeve
- 421 Operating sleeve
- 422 2nd gear
- 423 Needle bearing
- 424 Output shaft
- 425 Output flange
- 426 Collar nut
- 501 Needle bearing
- 502 Reverse gear
- 503 Thrust washer
- 504 Reverse gear shaft
- 505 Half-shell
- 506 Bolt

23-403



Drawing of Shift Elements

- 601 5th/reverse gear shift arm
- 602 Slide
- 603 Bearing shaft
- 604 1st/2nd gear shift arm
- 605 Locking lever
- 606 Shoulder shaft
- 607 3rd/4th gear shift arm
- 608 Cap
- 609 Spring
- 610 Catch pin
- 611 Circlip
- 612 Plug
- 613 Spring
- 614 Locking pin
- 615 Spring
- 616 Stop plate
- 617 Bolt
- 618 Roller
- 619 Selector arm
- 620 Spring
- 621 Gate plate
- 622 Bolt
- 623 Spring
- 624 Reversing lever
- 625 Retainer
- 626 Spring
- 627 Catch pin
- 628 Roller
- 629 Shift shaft
- 630 Shift shaft

23-404

23 12 505 REPLACING RADIAL OIL SEAL FOR INPUT SHAFT

Remove transmission – refer to 23 00 023 In Model Repair Manual.
Lift out spring (1) and remove release lever (3) together with release bearing (2).

Installation:

Fill lubricating groove (N) with Molykote Longterm 2.
Coat guides (F) and bearings (L) with Molykote Longterm 2.
Non-conformance could cause seizure of the release bearing on the guide sleeve.

Unscrew guide tube.

Remove radial oil seal.
Locate and puncture bores (1 and 2) with a scribe.
Drive in radial oil seal to one side as far as stop.
Screw a suitable self-tapping screw into the opposite bore.
Remove radial oil seal by pulling out on the self-tapping screw (pliers).

Lubricate sealing lip of radial oil seal with ATF.
Apply Special Tool 23 2 380 on the input shaft.
Slide on radial oil seal (1) as far as case.

Pull off Special Tool 23 2 380.
Drive in radial oil seal (1) flush with Special Tool 23 2 340.
Mount guide tube.
Tightening torque*.

* See Specifications

23-405

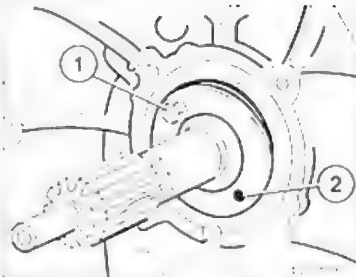
23 21 502 REMOVING AND INSTALLING INPUT AND OUTPUT SHAFT ASSEMBLY

Remove transmission – refer to 23 00 023 In Model Repair Manual.
Unscrew drain plug.
Drain oil.
Screw Special Tool 23 0 100 into drain plug bore and secure.
Take up Special Tool 23 0 100 in Special Tool 00 1 490.

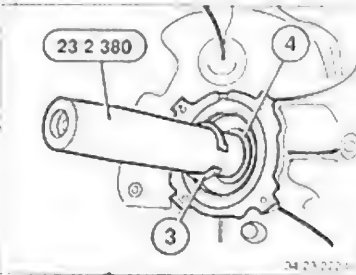
Lift out spring (1) and remove release lever (3) together with release bearing (2).

Installation:
Fill lubricating groove (N) with Molykote Longterm 2.
Coat guides (F) and bearings (L) with Molykote Longterm 2.
Non-conformance could cause seizure of the release bearing on the guide sleeve.

Unscrew guide tube.



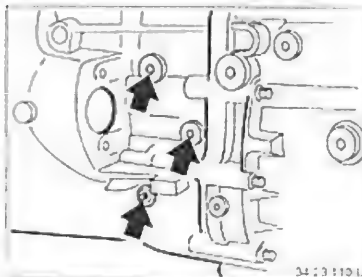
Remove radial oil seal.
Locate and puncture bores (1 and 2) with a scribe.
Drive in radial oil seal to one side as far as stop.
Screw a suitable self-tapping screw into the opposite bore.
Remove radial oil seal by pulling out on the self-tapping screw (pliers).



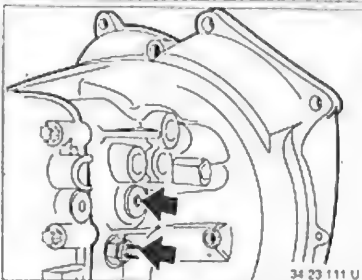
Caution!
Special Tool 23 2 380 must be used on the input shaft to remove circlip (3) so that the input shaft is not damaged.

Lift out circlip (3) and pull off over Special Tool 23 2 380.
Take off spacer (4).

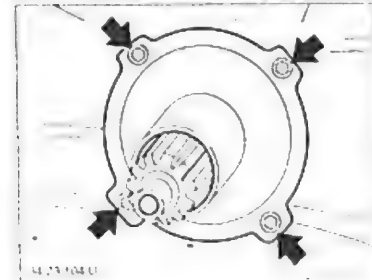
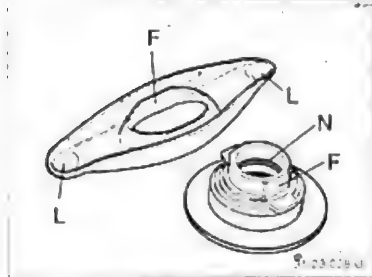
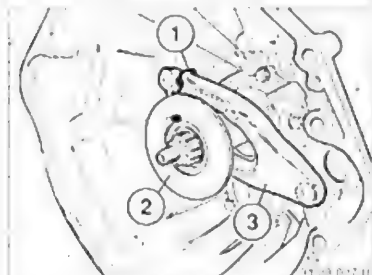
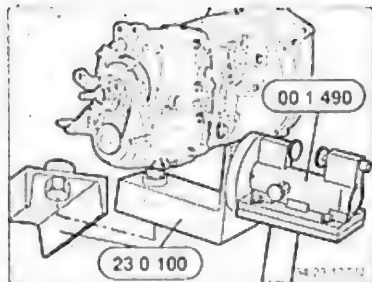
Installation:
Replace circlip (3).



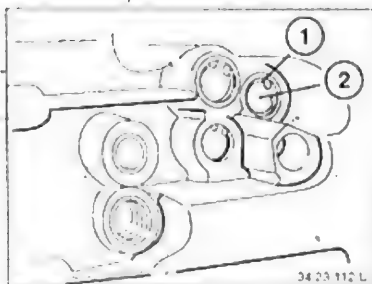
Unscrew left bearing shaft bolt and reverse gear shaft bolt in the front case section.



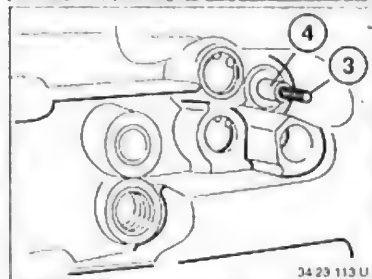
Unscrew reverse gear switch and right bearing shaft bolt in the front case section.



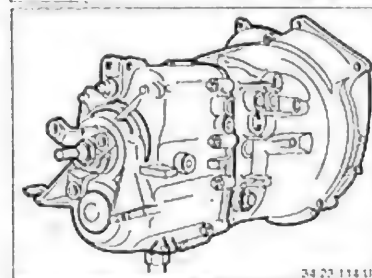
23-406



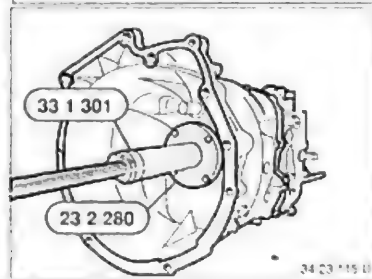
Lift out circlip (1).
Remove sealing cap (2).



Lift out spring (3) and catch pin (4).

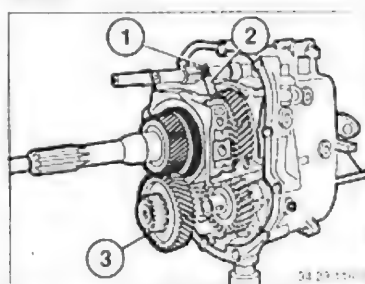


Unscrew case bolts.

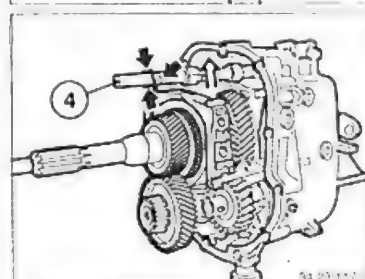


Pull off front case section using Special Tools 23 2 280 and 33 1 301.

Installation:
Bearings or elements of the bearing brackets could be damaged while pulling off the front case section.
Always replace bearings or elements.

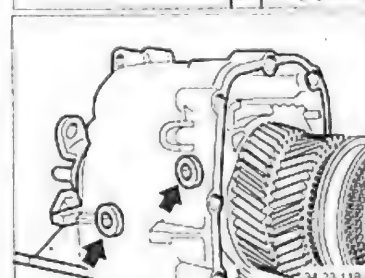


Remove loose spring (1) and thrust pin (2).
Take off needle bearing (3).

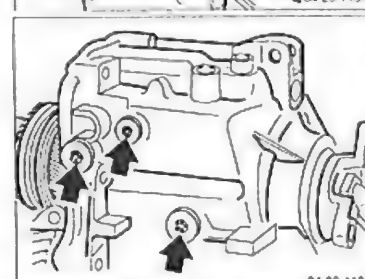


Pull out shift shaft (4).

Important!
Needles on shift shaft.
Take off 5th/reverse gear shift arm upwards.

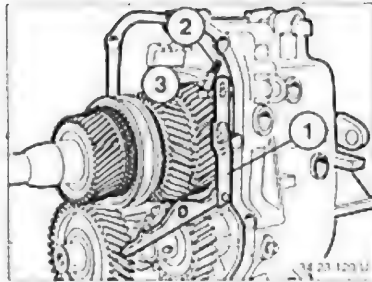


Remove two bearing shafts on the right-hand side.

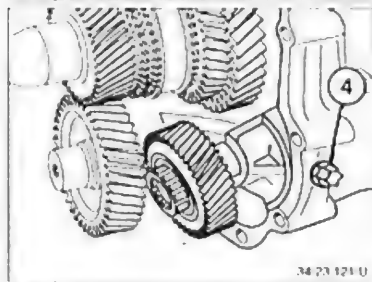


Remove three bearing shafts on the left-hand side.

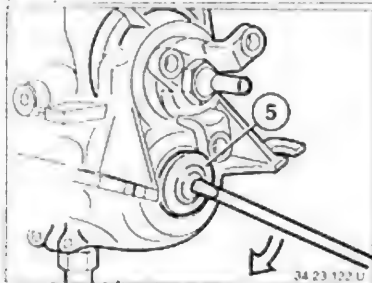
23-407



Remove complete locking lever (1).
Remove spring (2) and thrust pin (3).

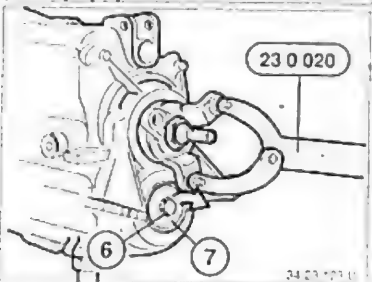


Unscrew bolt (4).
Remove reverse gear with needle bearings,
thrust washer, shaft and half-shell.



Puncture through middle of sealing cap (5).
Lever out sealing cap (5) with a screwdriver
inserted into the hole.

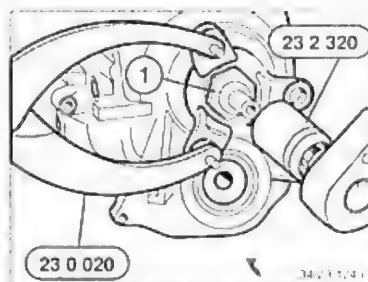
Installation:
Replace sealing cap.



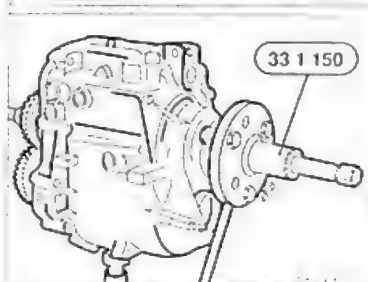
Engage a gear by hand.
Hold output flange with Special Tool
23 0 020.
Unscrew bolt (6).

Important!!
Left-hand threads.

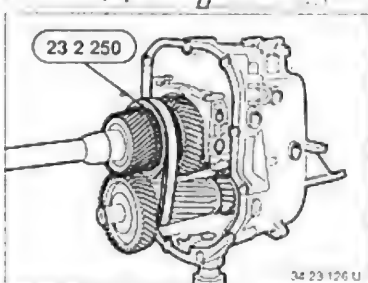
Remove washer (7).
Take out engaged gear.



Hold output flange with Special Tool
23 0 020.
Unscrew collar nut (1) with Special Tool
23 2 320.

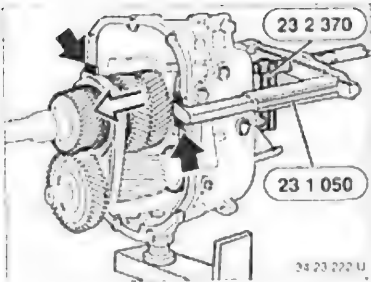


Pull off output flange using Special Tool
33 1 150.



Compress gear set at 5th/reverse gear
operating sleeve with layshaft.
Use Special Tool 23 2 250.

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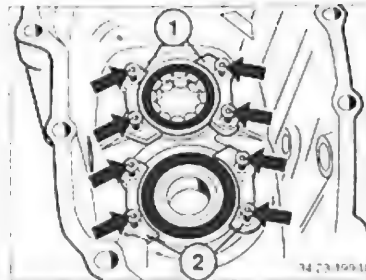
Apply Special Tool 23 2 370 on output shaft and layshaft.
Apply Special Tool 23 1 050 on case sealing surface and middle of Special Tool 23 2 370.

Important!

Use a piece of wood, plastic or similar on the sealing surfaces.
Press out gear set and layshaft uniformly.
Make sure that the gear set and layshaft do not clamp while pressing out.

Installation:

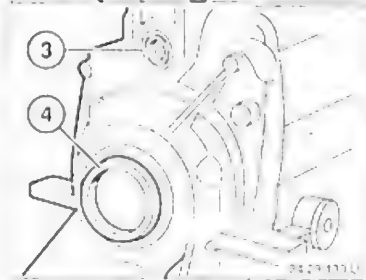
The bearings or elements of the bearing brackets could be damaged while pressing out the input shaft and output shaft.
Always replace bearings or elements after removal.



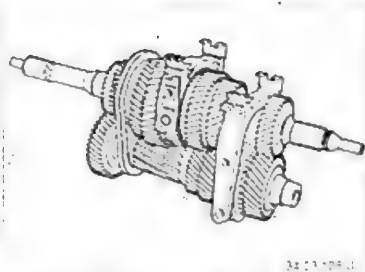
Replace bearings or elements for bearing brackets of the output shaft/layshaft (also refer to 23 21 705).
Screw on elements (1 and 2).

Installation:

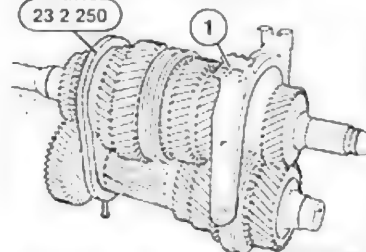
Install bolts with a bolt cement**.
Tightening torque*.



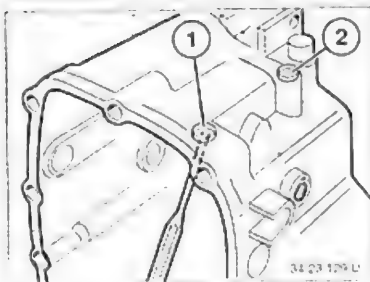
Lever out radial oil seals (3 and 4) for the output shaft and shift shaft.



Take out gear set with 1st/2nd and 3rd/4th gear shift arms and layshaft.



Compress the gear set at the 5th/reverse gear operating sleeve with the layshaft.
Use Special Tool 23 2 250.
Place 3rd/4th gear shift arm with slide on the 3rd/4th gear operating sleeve.
Have the shift arm bear on the 3rd gear of the output shaft.
Install shift arm with lock (1) in direction of the left-hand side input shaft.

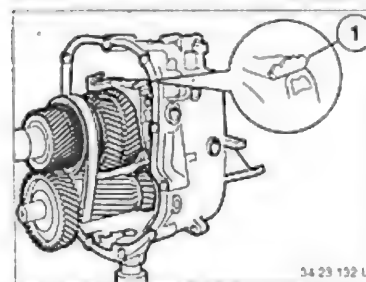


Installing:

Clean the case.
Drive out sealing caps (1 and 2) on the rear case section from inside to outside using a mandrel.

Installation:

Replace sealing caps.



Place gear set with shift arm in the rear case section.
Place 1st/2nd gear shift arm with slide in the 1st/2nd gear operating sleeve.

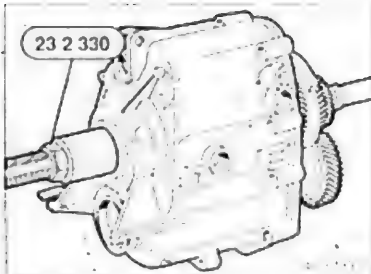
Important!

Mount the shift arm with lock (1) in direction of the left-hand side input shaft.

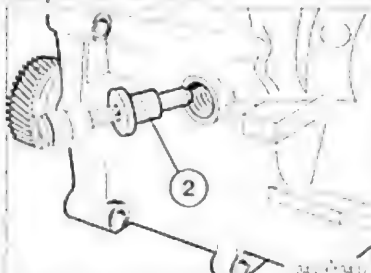
* See Specifications

** Source of Supply: BMW Parts

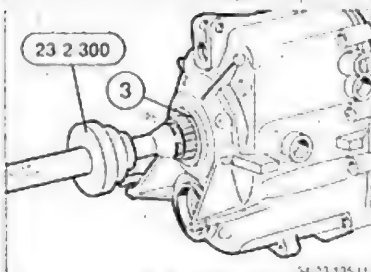
23-409



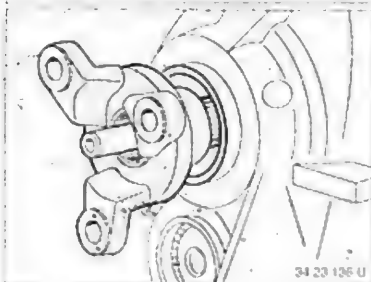
Apply Special Tool 23 2 330 on the output shaft journal.
Pull output shaft in to fit tight with Special Tool 23 2 330.
Make sure that shift arms and layshaft are not canted while pulling in; align if necessary.
Remove Special Tool 23 2 330.



Center the 3rd/4th gear shift arm with the bore in the case by hand.
Screw in bearing shaft (2) on left and right sides separately by hand in this position and then tighten them.
Tightening torque*.

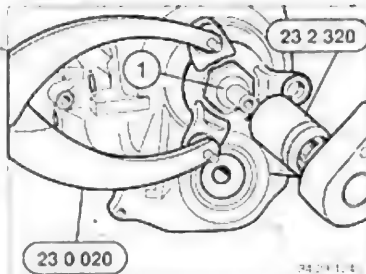


Lubricate sealing lip of radial oil seal with oil.
Drive in radial oil seal (3) for the output flange with Special Tool 23 2 300.

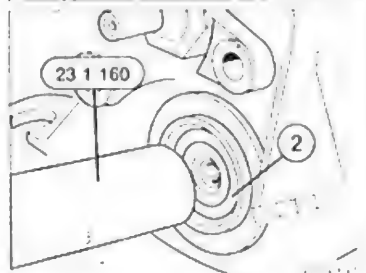


Heat output flange to about 80° C with a hot air blower.
Slide output flange on to the output shaft.
If necessary, drive on to fit tight with Special Tool 23 1 160.

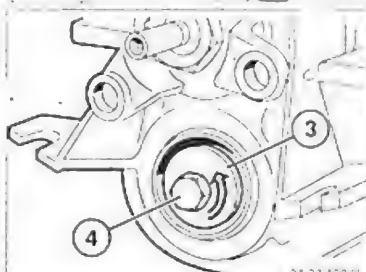
* See Specifications



Install collar nut (1) with bolt cement** that its flat side faces the output flange.
Hold output flange with Special Tool 23 0 020.
Tighten collar nut with Special Tool 23 2 320.
Tightening torque*.

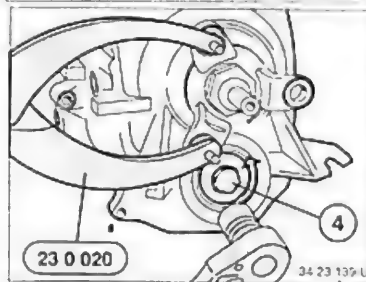


Heat ball bearing inner race (2) for layshaft to about 80° C with a hot air blower.
Press on ball bearing inner race (2) to fit tight with Special Tool 23 1 160; drive on with light knocks if necessary.



Install washer (3) and bolt (4) with bolt cement**.

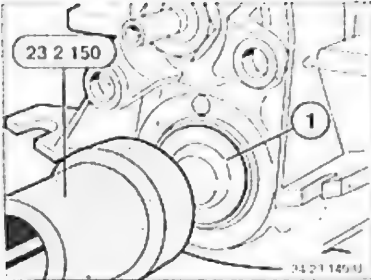
Important!
Bolt (4) has left-hand threads.



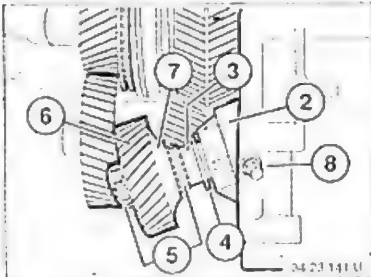
Remove Special Tool 23 2 250 from the gear set.
Engage a gear.
Hold output flange with Special Tool 23 0 020.
Tighten bolt (4).
Tightening torque*.
Disengage the gear.

* See Specifications
** Source of Supply: BMW Parts

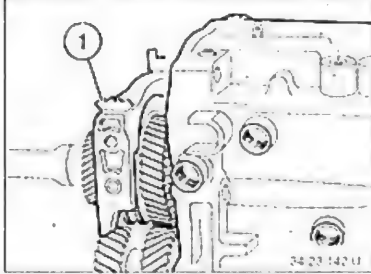
23-410



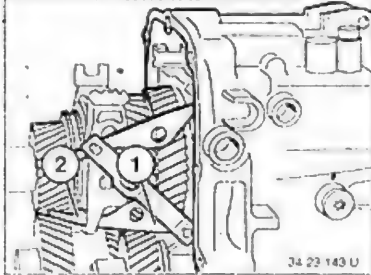
Insert and drive in sealing cap (1) flush with Special Tool 23 2 150.



Coat half-shell (2) in area of the bolt bore with a sealing compound** and install. Install shaft (3), thrust washer (4), needle bearing (5) and reverse gear (6) with shoulder (7) facing the case. Coat shoulder of the bolt head with sealing compound**. Install bolt (8) with bolt cement**, but do not tighten.

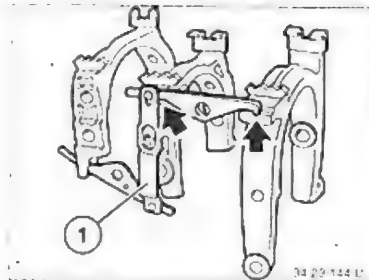


Install 5th/reverse gear shift arm and slide with catch (1) facing to the left in the 5th/reverse gear operating sleeve.

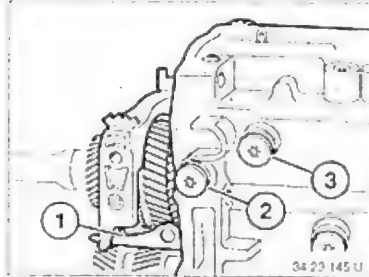


Guide in locking lever (1) with long tongue (2) in the slot of the 5th/reverse gear shift arm.

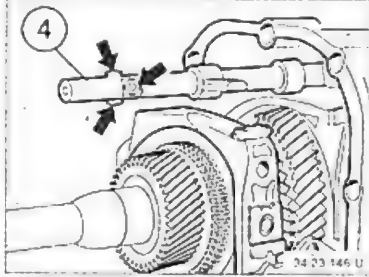
* See Specifications
** Source of Supply: BMW Parts



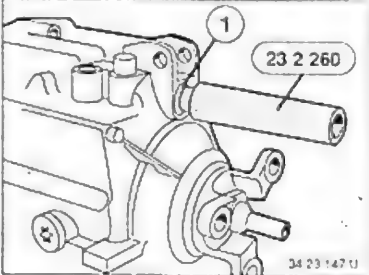
Swing locking lever (1) towards the inside and in so doing attach it in the openings of the 1st/2nd and 3rd/4th gear shift arms.



Center locking lever (1) with the bores by hand. Install bearing shafts (2 and 3) on left and right sides by hand and then tighten them. Tightening torque*. Check movement of the locking lever.



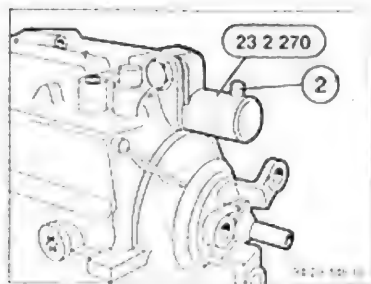
Guide in shift shaft (4) horizontally. Hold four needles in position with grease.



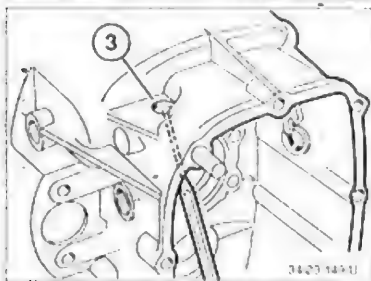
Drive in radial oil seal (1) for the shift shaft with Special Tool 23 2 260.

* See Specifications

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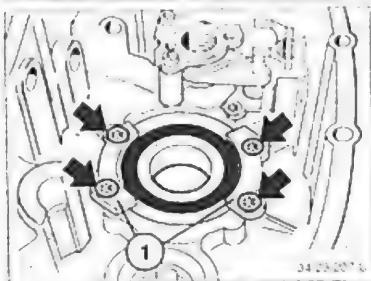


Hold the shift shaft in neutral position with Special Tool 23 2 270.
Use a 6 mm bolt and cylindrical pin (2) from the shift joint or a suitable mandrel for holding the shift shaft.



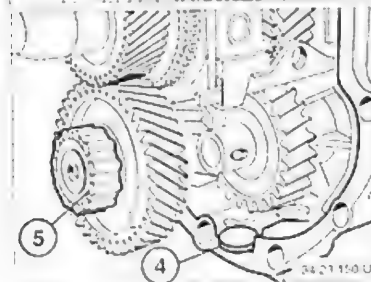
Clean the front case section.
Drive out sealing cap (3) for the catch pin from inside to outside using a punch.

Installation:
Replace sealing cap.



Replace bearings or elements for bearing brackets of the output shaft (also refer to 28 21 705).
Unscrew elements (1).

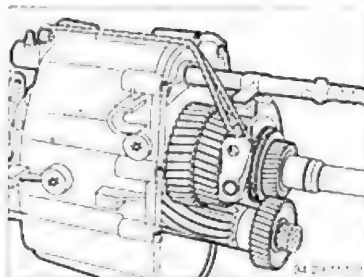
Installation:
Install bolts with a bolt cement**.
Tightening torque*.



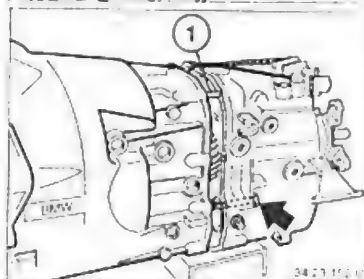
Place magnet (4) in the rear case section.
Install needle bearing (5) with the small diameter end on the outside.

Note:
Coat needles with grease and press them in to avoid canting of the needles when mounting the front case section.
Clean and coat case sealing surfaces with a sealing compound**.

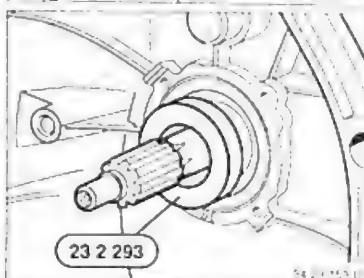
* See Specifications
** Source of Supply: BMW Parts



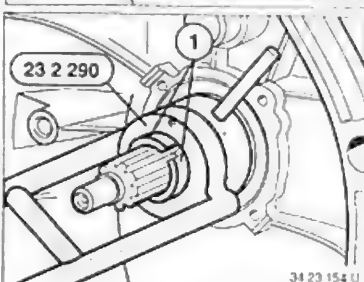
Hold the 5th/reverse gear shift arm in horizontal position with a piece of string to make installation easier.



Mount the front case section as far as centering pins (1).
Screw two 8 x 75 mm bolts into the rear case section opposite each other on the left and right sides to center the case.

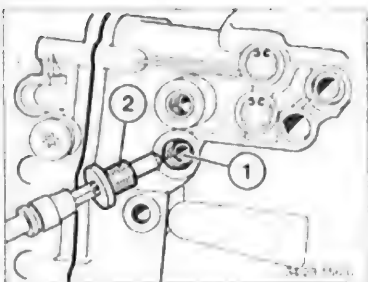


Place Special Tool 23 2 293 (thrust ring) from Special Tool 23 2 290 in the front case section.

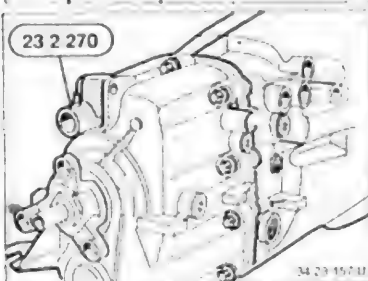


Apply Special Tool 23 2 290 on the input shaft.
Place supporting shells (1) on the input shaft that the tapered sides face in.
Unscrewing the spindle presses the front case section on to the input shaft.

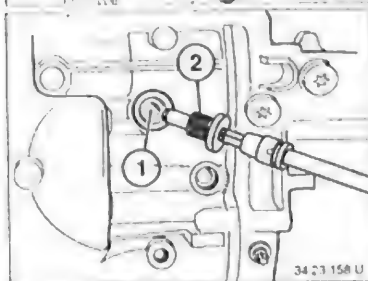
23-412



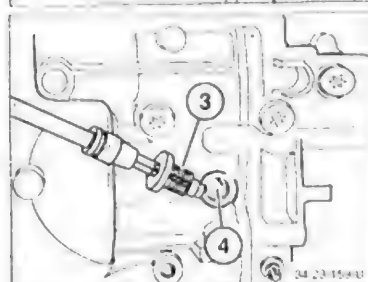
Press the front case section on only so far that the piece of string can still be removed after installation of the right bearing shaft. Center 5th/reverse gear shift arm (1) with the bore and screw in the right bearing shaft (2) by hand, but do not tighten. Remove piece of string. Press on the front case section as far as stop.



Remove complete Special Tool 23 2 290. Remove centering bolts from case. Bolt front case section to rear section. Tightening torque*. Remove Special Tool 23 2 270 from shift shaft.

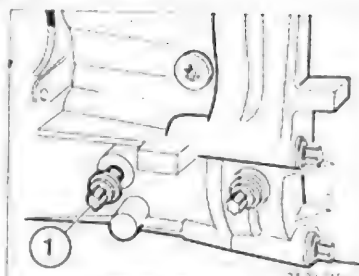


Center 5th/reverse gear shift arm (1) with the bore and screw in the left bearing shaft (2) by hand. Tighten left and right bearing shafts (2). Tightening torque*.

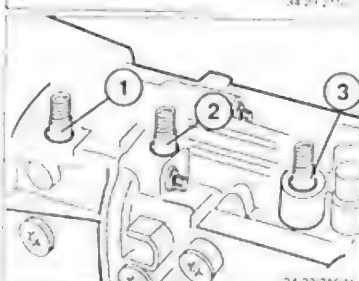


Install bearing shaft (3) for the locking lever. This requires turning the transmission until bore (4) in the locking lever is aligned with the bore in the case. In this position screw in bearing shaft (3) by hand and then tighten. Tightening torque*.

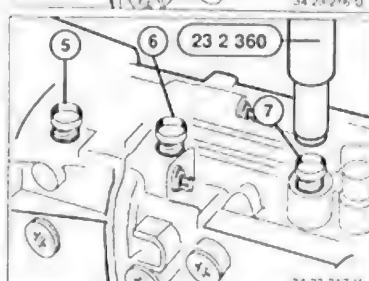
* See Specifications



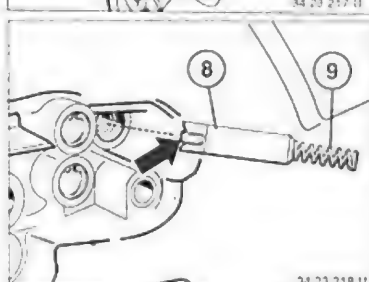
Coat shoulder of the bolt head with a sealing compound**. Install bolt (1) for the reverse gear shaft bolt with a bolt cement**. Tighten bolt bolts. Tightening torque*.



Place catch pins (1 ... 3) with springs in the shift arms.



Knock in sealing caps (5 ... 7) with Special Tool 23 2 360.



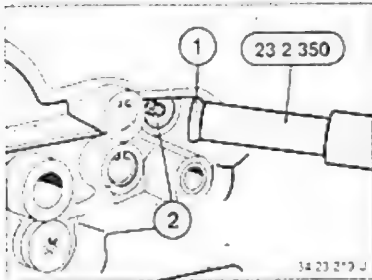
Catch pin (8) and spring (9)

Important!!
Check installed position of catch pin (8). Roller must be horizontal.

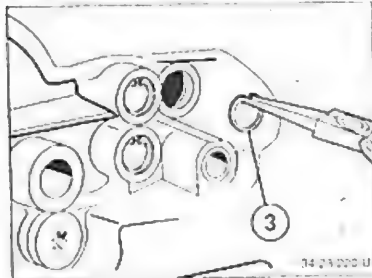
* See Specifications

** Source of Supply: BMW Parts

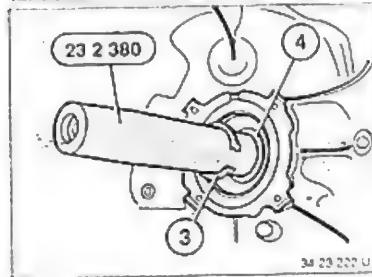
23-413



Install sealing cap (1) in bore (2) with help of Special Tool 23 2 350 and push in as far as possible.

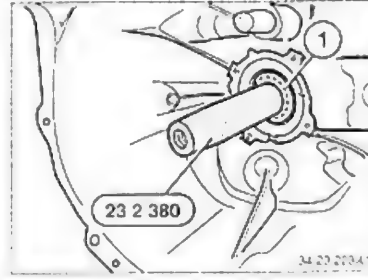


Install circlip (3) and press in as far as groove with Special Tool 23 2 350. Check for correct seating of the circlip (visual inspection). Install the reverse gear switch.

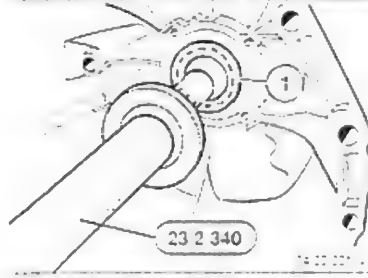


Install spacer (4).

Caution!
Special Tool 23 2 380 must be used on the input shaft while installing circlip (3) to avoid damaging the input shaft. Slide circlip (3) over Special Tool 23 2 380 and install it in the groove. The circlip must seat in the groove without play. Replace circlip with a circlip of correct thickness. Circlips are available in different thicknesses in steps from 2.2 to 2.6 mm.



Lubricate sealing lip of the radial oil seal with ATF. Apply Special Tool 23 2 380 on the input shaft. Push on radial oil seal (1) as far as the case.



Remove Special Tool 23 2 380. Drive in radial oil seal (1) flush with Special Tool 23 2 340. Mount guide tube. Tightening torque*.

* See Specifications

23-414

23 21 705 REPLACING BEARINGS OF ALL TRANSMISSION SHAFTS - Input and Output Shafts Removed -

Rear Case Section:
Unscrew bolts.
Remove elements (1 and 2).

Lever out radial oil seal for the output flange.

Installation:
Replace radial oil seal.

Drive out the ball bearing for the output shaft toward the inside, using Special Tool 23 1 440.

Layshaft:
Heat case in area of the ball bearing to about 60° C with a hot air blower.
Remove ball bearing (1) toward the inside.
Clean the rear case section to remove dirt.

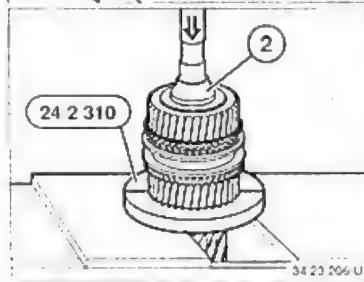
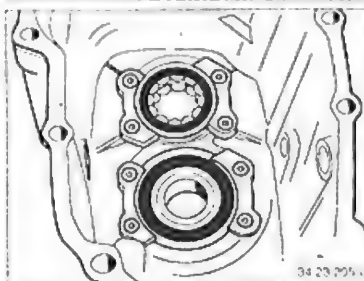
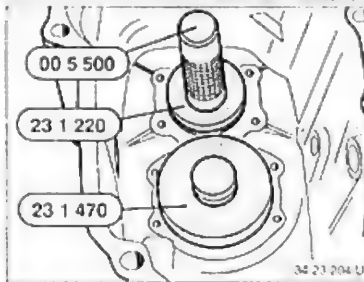
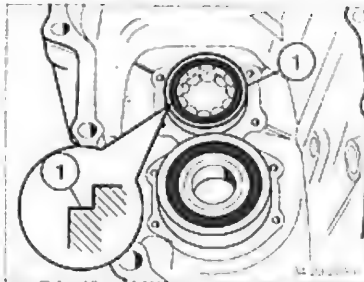
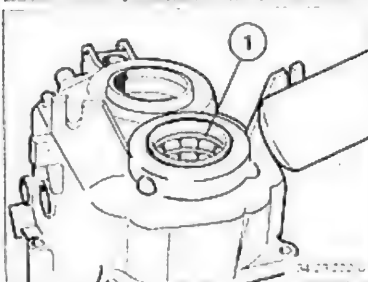
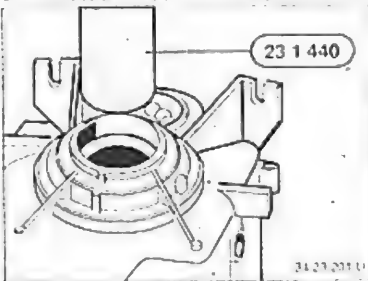
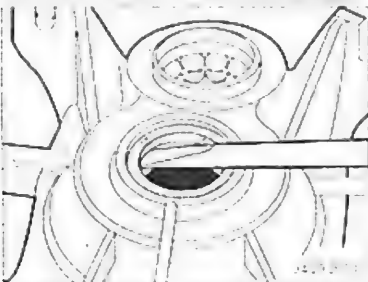
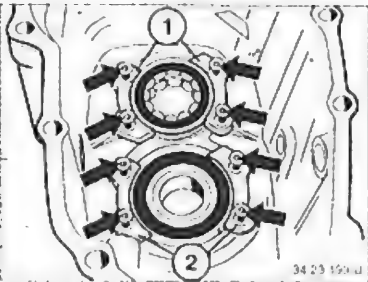
Heat rear case section in area of the ball bearing uniformly to about 60° C with a hot air blower.
Install ball bearings for output shaft and layshaft.
Insert ball bearing for the layshaft with the shouldered end (1) facing in.

If necessary, drive in ball bearings to fit tight.
Use Special Tool 23 1 470 for the output shaft and Special Tool 23 1 220 for the layshaft in conjunction with Special Tool 00 5 500.

Install elements.
Install bolts with a bolt cement** and tighten.
Tightening torque*.

The 3rd/4th gear has to be pressed off with Special Tool 23 2 310 to be able to replace bearing inner race (2).
Removal - refer to "Replacing 3rd/4th Gear Synchronization" in 23 23 507.

* See Specifications
** Source of Supply: BMW Parts



23-415

Bearings in Front Case Section

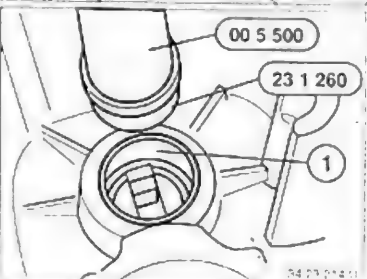
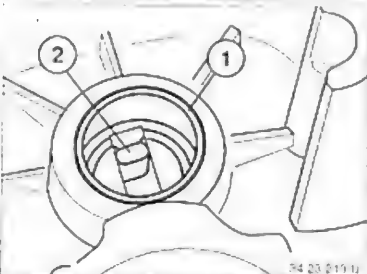
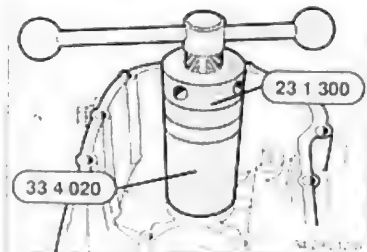
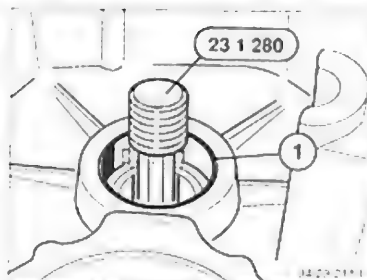
Input shaft:
Unscrew bolts.
Remove elements (1).

Heat case in area of the ball bearing to about 80° C with a hot air blower.
Pull out ball bearing (2); if necessary drive it out from outside to inside with help of Special Tool 23 1 440.

Heat case in area of the ball bearing to about 80° C with a hot air blower.
Install ball bearing (2); if necessary drive it in to fit tight with Special Tool 23 1 470.

Install elements (1).
Install bolts with a bolt cement** and tighten.
Tightening torque*.

- * See Specifications
- ** Source of Supply: BMW Parts



Layshaft:

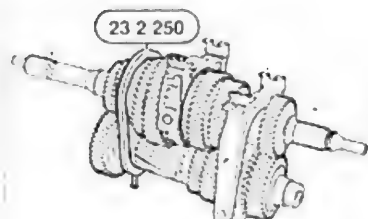
1 = bearing shell for needle bearing
Place Special Tool 23 1 280 in bearing shell (1).

Apply Special Tool 33 4 020.
Screw on Special Tool 23 1 300.
Pull bearing shell out.

Installation:
Insert bearing shell (1) that the slot in the bearing shell is aligned with beads (2) (turning lock) in the case.

Drive in bearing shell (1) with Special Tools 23 1 260 and 00 5 500.

23-416



23 23 507 DISASSEMBLING AND ASSEMBLING COMPLETE SYNCHRONIZATION

Remove input and output shaft assembly – see 23 21 502.
Pull off 1st/2nd and 3rd/4th gear shift arms.
Remove Special Tool 23 2 250.

Pull off input shaft (1), synchronmesh ring (2) and needle bearing (3).

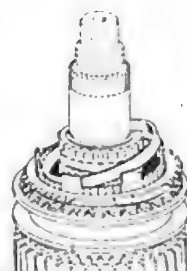
Clamp gear set in a vise fitted with soft jaws on the output shaft.
Pull off the 5th/reverse gear operating sleeve.

Important!
Loose thrust pieces, balls and springs.

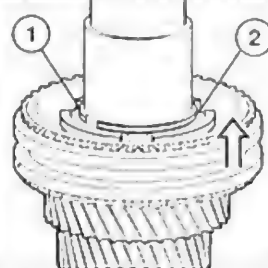
Remove circlip (4) and spacer (5).

Installation:
Replace circlip (4).

Move the 1st/2nd gear operating sleeve in direction of the 2nd gear.
Place pressing-off liners on the 1st gear.
Press the guide sleeve, reverse gear with synchronmesh ring, needle bearing and bearing sleeve, 1st gear and thrust washer off of the output shaft.



Pull off the needle bearing, synchronmesh ring, intermediate ring and outer race.

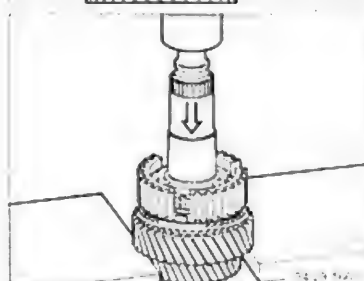


Pull off the 1st/2nd gear operating sleeve.

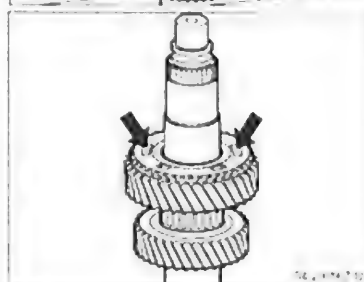
Important!
Loose thrust pieces, balls and springs.

Lift out circlip (1).
Take off spacer (2).

Installation:
Replace circlip (1).

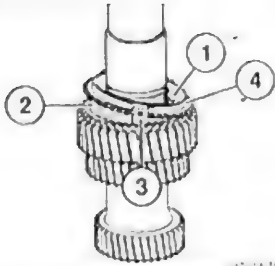


Place pressing-off liners on the 2nd gear.
Press the guide sleeve, 2nd gear with synchronmesh ring and needle bearing off of the output shaft.

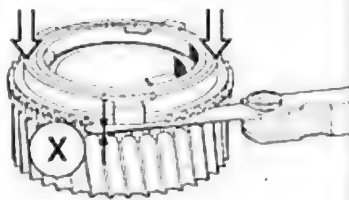


Assembling Gear Set:
Mount needle bearing and 2nd gear with the openings facing up.

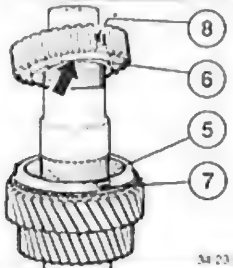
23-417



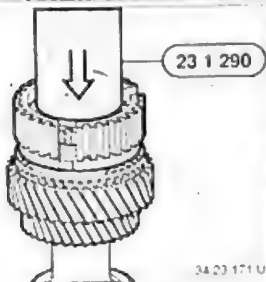
Install synchronization, consisting of:
Inner race (1), intermediate ring (2) with dogs (3) in the openings of the 1st gear and synchromesh ring (4).



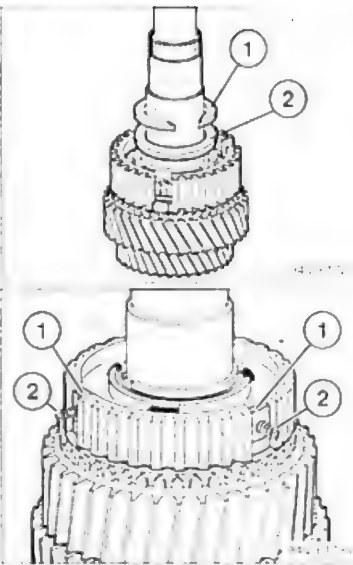
Inspect the 2nd gear synchronization for wear.
Measure distance X between the gear and synchromesh ring.
In so doing press down uniformly on the synchromesh ring by hand.
Specification: at least 0.9 mm.
Actual new part distance: 1.1 ... 1.6 mm.
When replacing, all three parts must be replaced at one time.



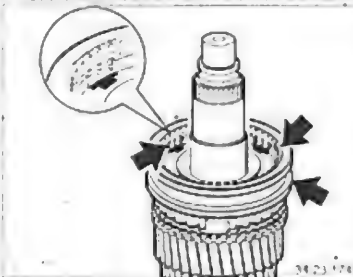
Heat guide sleeve to about 80° C with a hot air blower.
Mount the guide sleeve with the long shoulder facing the 2nd gear.
When mounting make sure that dogs (5) of the inner race are aligned with openings (6) in the gear.
In addition dogs (7) on the synchromesh ring must engage in grooves (8) of the guide sleeve.



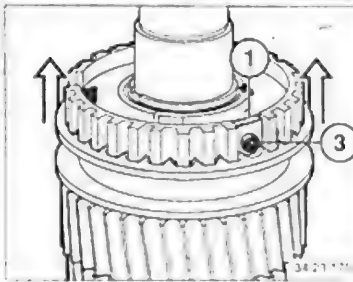
Press on guide sleeve to fit tight with Special Tool 23 1 290.



Install spacer (2).
Insert circlip (1).
The circlip must seat in the groove without play; if necessary replace spacer (1).
Spacers are available in different thicknesses in steps from 1.8 to 2.05 mm.

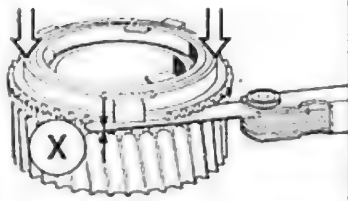


Mount the 1st/2nd gear operating sleeve with the flat side facing up or the bevelled side facing the 2nd gear.
The three set-back or opened teeth must point to the springs.



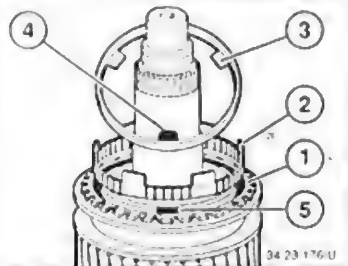
Tilt thrust pieces (1) out of the operating sleeve separately far enough that balls (3) can be placed on the springs.
Push in balls (3) and simultaneously press the thrust pieces into the operating sleeve.
Pull the operating sleeve upwards uniformly as far as the lock (neutral position).

23-418



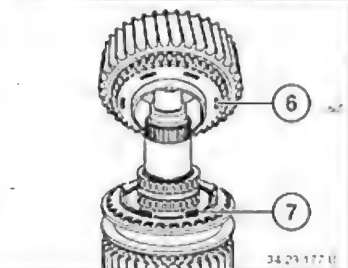
34 23 169 U

Inspect the 1st gear synchronization for wear.
Measure distance X between the gear and synchronesh ring.
In so doing press down uniformly on the synchronesh ring by hand.
Specification: at least 0.9 mm.
Actual new part distance: 1.1 ... 1.6 mm.
When replacing, all three parts must be replaced at one time.



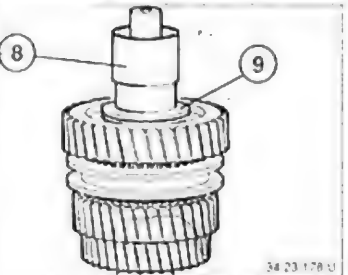
34 23 176 U

Install synchronesh ring (1), intermediate ring (2) and inner race (3) with dogs (4) in openings (5) of the guide sleeve.



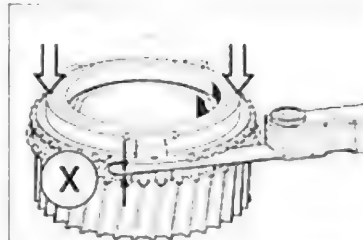
34 23 177 U

Mount needle bearing.
Install the 1st gear with grooves (6) facing the dogs (7).



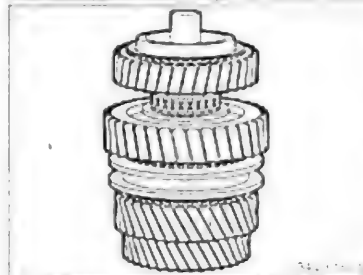
34 23 178 U

Heat thrust washer (9) and bearing sleeve (8) to about 80° C with a hot air blower and install then on the output shaft, pressing on if necessary.
Use Special Tool 23 1 290 for thrust washer.
Use Special Tool 33 1 342 for bearing sleeve.



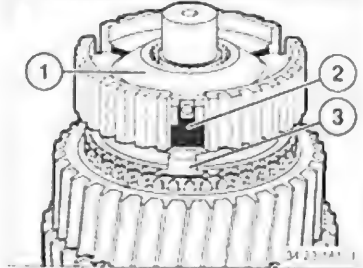
34 23 169 U

Inspect the reverse gear synchronization for wear.
Measure distance X between the gear and synchronesh ring.
In so doing press down uniformly on the synchronesh ring by hand.
Specification: at least 0.5 mm.
Actual new part distance: 0.7 ... 1.15 mm.



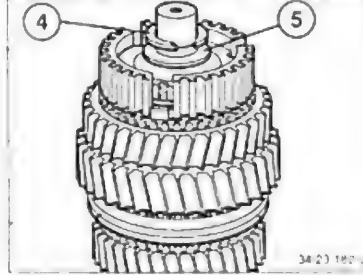
34 23 176 U

Mount the needle bearing and reverse gear.



34 23 177 U

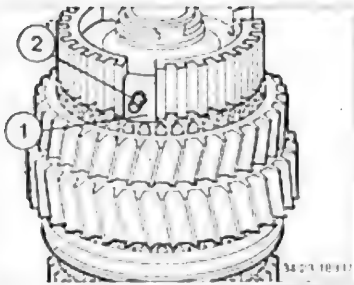
Place the reverse gear synchronesh ring on the reverse gear cone.
Heat the 5th/reverse gear guide sleeve to about 80° C with a hot air blower and install it on the output shaft with conical end (1) facing up; if necessary press on to fit tight with Special Tool 33 1 342.
Make sure that dogs (3) engage in opening (2).



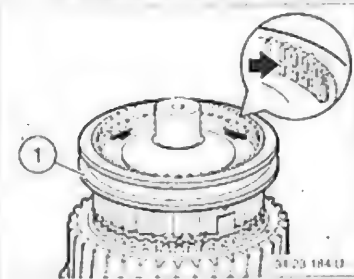
34 23 180 U

Install spacer (5) and circlip (4).
Circlip (4) must seat in the groove without play; replace spacer if necessary.
Spacers are available in different thicknesses in steps from 3.6 to 4.0 mm.
Knock in the circlip slightly.

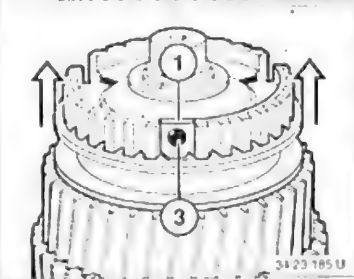
23-419



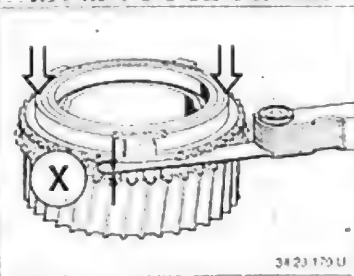
Place three thrust pieces (1) and three springs (2) in the opening of the guide sleeve.



Install the operating sleeve with shouldered end (1) facing the reverse gear.



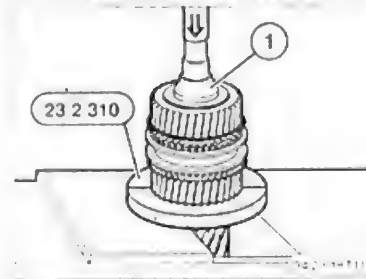
Tilt thrust pieces (1) out of the operating sleeve separately far enough that ball (3) can be placed on the springs. Press balls (3) in and simultaneously push the thrust pieces into the operating sleeve. Install the 5th gear synchronmesh ring in the operating sleeve. Pull the operating sleeve upwards uniformly as far as the lock (neutral position).



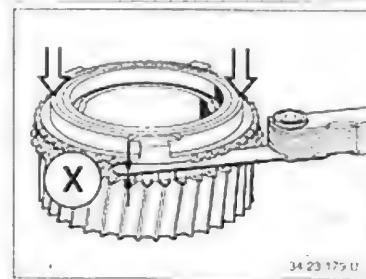
Inspect the 5th gear synchronization for wear. Measure distance X between the gear and synchronmesh ring. In so doing press down uniformly on the synchronmesh ring. Specification: at least 0.75 mm. Actual new part distance: 0.95 ... 1.35 mm.



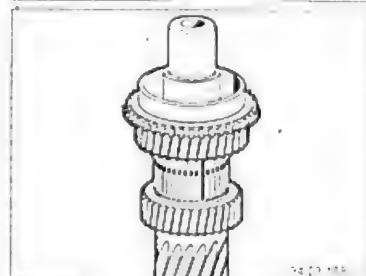
Install synchronmesh ring. Install needle bearing and input shaft with the 5th gear.



Layshaft:
Replace the 3rd/4th gear synchronization. Apply Special Tool 23 2 310 on the 3rd gear. Press bearing inner race (1), thrust washer, 4th gear with needle bearing, synchronization and 3rd gear with needle bearing off of the layshaft.

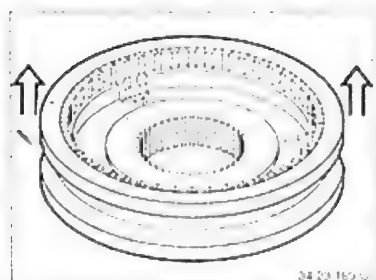


Assembling:
Inspect the 3rd/4th gear synchronization for wear. Measure distance X between the gear and synchronmesh ring. In so doing press down uniformly on the synchronmesh ring. Specification: at least 0.75 mm. Actual new part distance: 0.95 ... 1.35 mm.



Install needle bearing and 4th gear.

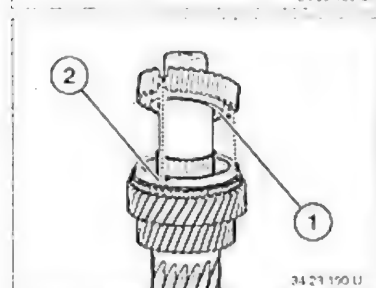
23-420



34 23 169 U

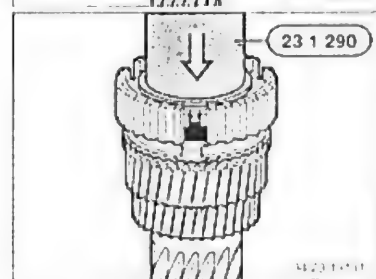
Pull the 3rd/4th gear operating sleeve off of the guide sleeve.

Important!
Loose balls, springs and thrust pieces.



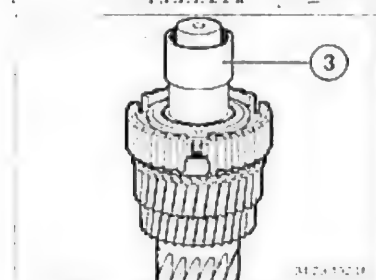
34 23 190 U

Place the synchronesh ring on the 3rd gear cone.
Heat the 3rd/4th gear guide sleeve to about 80° C with a hot air blower.
Install the guide sleeve with long shoulder (1) facing the 3rd gear.
When installing make sure that dogs (2) are aligned with the openings in the guide sleeve.



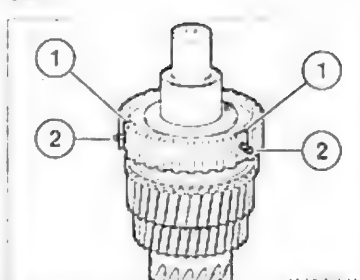
34 23 191 U

If necessary, press the guide sleeve on to fit tight with help of Special Tool 23 1 290.



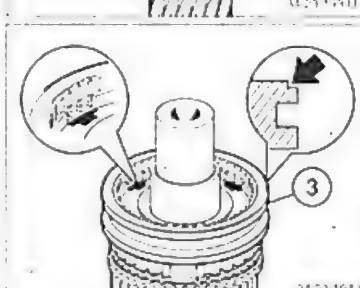
34 23 192 U

Heat bearing inner race (3) to about 80° C with a hot air blower and install it on the layshaft.
If necessary, press it on to fit tight with help of Special Tool 33 1 342.



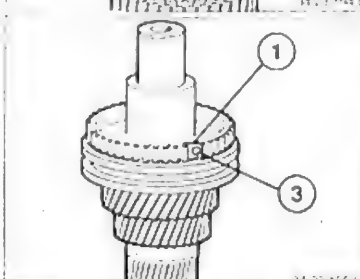
34 23 193 U

Insert three thrust pieces (1) and three springs (2) into the opening of the guide sleeve.



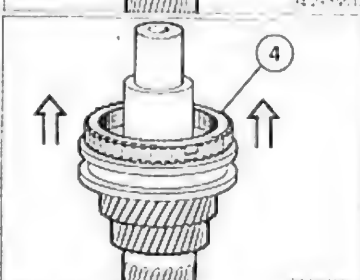
34 23 194 U

Install the 3rd/4th gear operating sleeve with the shouldered end (3) facing up.
The three set-back or opened teeth must point to the springs.



34 23 195 U

Tilt thrust pieces (1) out of the operating sleeve separately far enough that balls (3) can be placed on the springs.
Press balls (3) in and simultaneously push the thrust pieces into the operating sleeve.



34 23 196 U

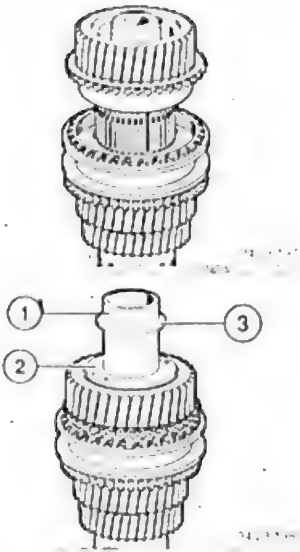
Install synchronesh ring (4) in the openings of the guide sleeve.
Pull the operating sleeve upwards uniformly as far as the lock (neutral position).

23-421

Install needle bearing and 4th gear.

Important!

Needle bearings are selected by the manufacturers according to certain tolerances and have a green color code. Do not mix up with other needle bearings.



Heat thrust washer (2) and bearing inner race (1) to about 80° C with a hot air blower and install on the layshaft with shoulder (3) facing down. If necessary, press them on to fit tight with help of Special Tool 23 1 160.

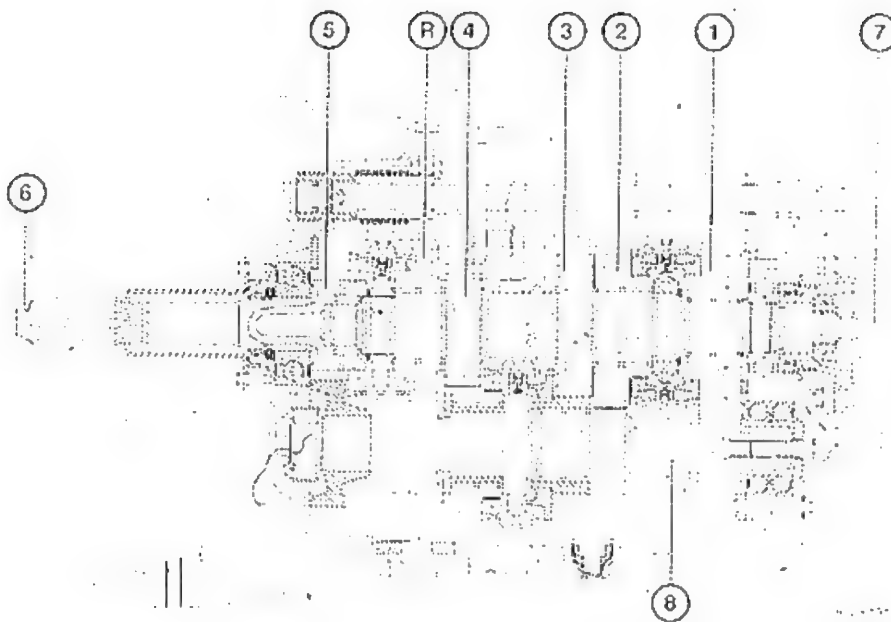
Construction group 23 Manual transmission

Five speed manual transmissions – type S5 D 200 G / 250 G

	Transmission – layout drawing	23- 450
	Shift elements – layout drawing	23- 451
23 12 506	Radial oil seal for input shaft – replace	23- 452
23 21 505	Input and output shaft assembly – remove and install	23- 453
706	Bearings of all transmission shafts – replace	23- 461
23 23 508	Synchronization – disassemble and assemble	23- 464

23-450

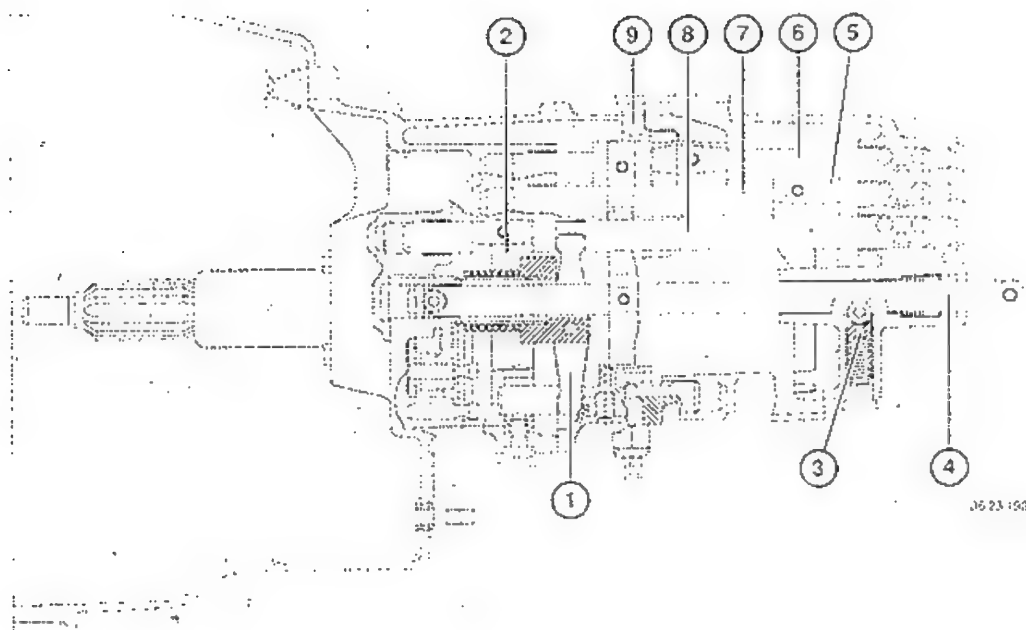
Cross Section Drawing of Transmission



- 1 First gear
- 2 Second gear
- 3 Third gear
- 4 Fourth gear
- 5 Fifth gear
- R Reverse gear
- 6 Input shaft
- 7 Output shaft
- 8 Layshaft

23-451

Cross Section Drawing of Shift Elements



- 1 Reversing lever
- 2 5th/reverse gear shift fork
- 3 Lock pin
- 4 Shift shaft
- 5 1st/2nd gear shift fork
- 6 3rd/4th gear shift rod
- 7 1st/2nd gear shift rod
- 8 5th/reverse gear shift rod
- 9 3rd/4th gear shift fork

36 23-150

23-452

23 12 506 REPLACING RADIAL OIL SEAL FOR INPUT SHAFT

Remove transmission – refer to 23 00 023 in Model Repair Manual.
Lift out spring (1) and remove release lever (3) together with release bearing (2).

Installation:

Fill lubricating groove (N) with Klüber Microlube GL 261**. Coat guides (F) and bearings (L) with Klüber Microlube GL 261**. Non-conformance could cause seizure of the release bearing on the guide sleeve.

Unscrew guide tube.

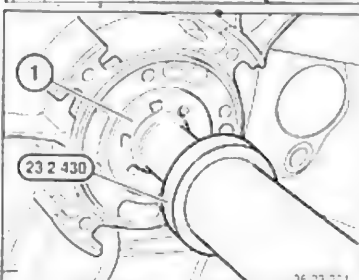
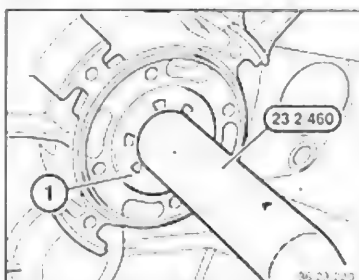
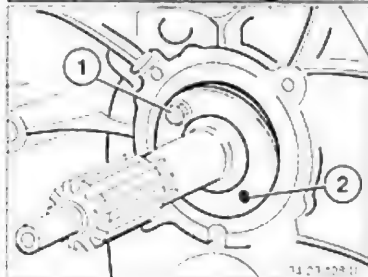
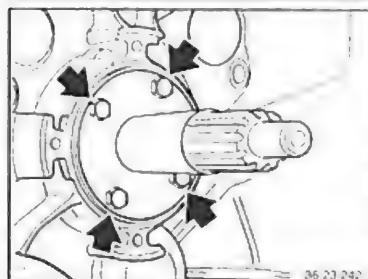
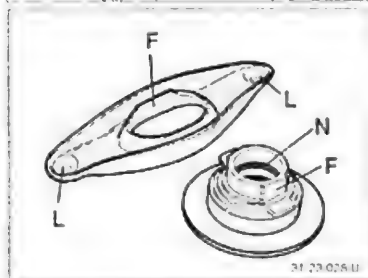
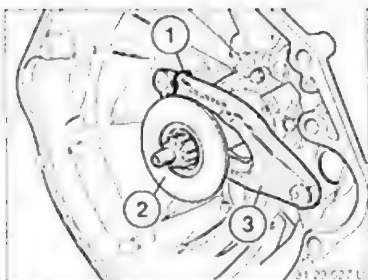
Remove radial oil seal.
Locate and puncture through bores (1 and 2) with a scriber.
Drive in radial oil seal to one side as far as stop.
Screw a suitable self-tapping screw into the opposite bore.
Remove radial oil seal by pulling out on the self-tapping screw (use pliers).

** Source of Supply: BMW Parts

Lubricate sealing lip of radial oil seal with ATF.
Apply Special Tool 23 2 460 on the input shaft.
Slide on radial oil seal (1) as far as case.

Pull off Special Tool 23 2 460.
Drive in radial oil seal (1) flush with Special Tool 23 2 430.
Use a plastic hammer to drive in seal.
Mount guide tube.
Install bolts with bolt cement Loctite No. 242.
Tightening torque*.

* See Specifications



23-453

23 21 505 REMOVING AND INSTALLING INPUT AND OUTPUT SHAFT ASSEMBLY

Remove transmission – refer to 23 00 023 in Model Repair Manual.
Unscrew drain plug.
Drain oil.
Screw Special Tool 23 0 100 into oil drain plug bore and secure.
Take up Special Tool 23 0 100 in Special Tool 00 1 490.

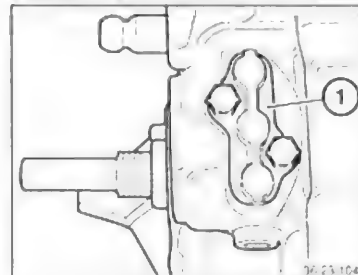
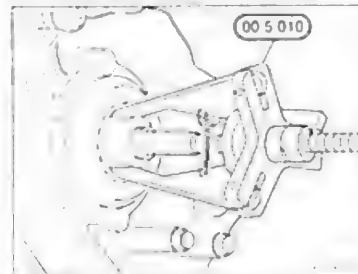
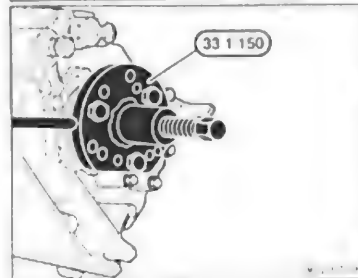
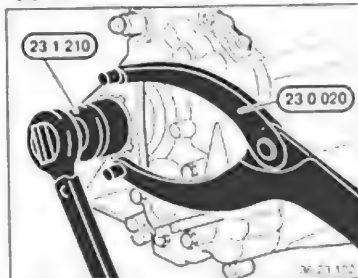
Lift out spring (1) and remove release lever (3) together with release bearing (2).

Installation:
Fill lubricating groove (N) with Klüber Microlube GL 261**.
Coat guides (F) and bearings (L) with Klüber Microlube GL 261**.
Non-conformance could cause seizure of the release bearing on the guide sleeve.

Lift out lock plate (1).

Installation:
Replace lock plate.

** Source of Supply: BMW Parts



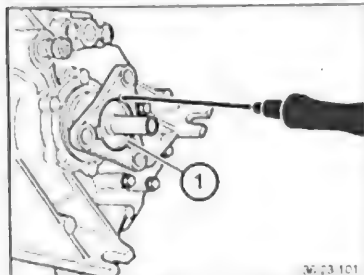
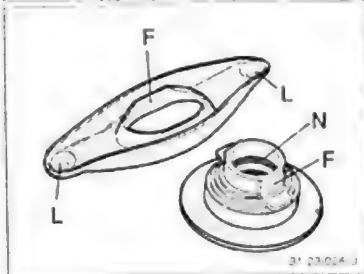
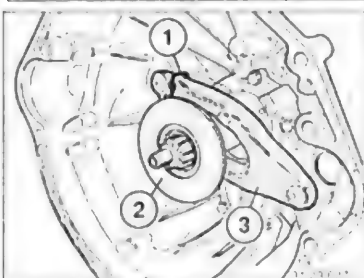
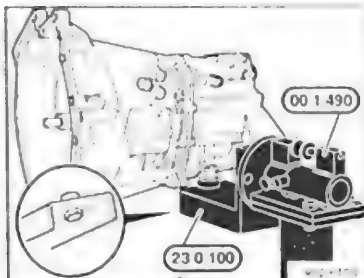
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.

Pull off output flange by hand.
If too difficult, pull off output flange with Special Tool 33 1 150.

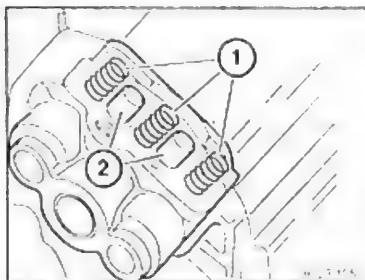
Pull out radial oil seal with Special Tool 00 5 010.

Installation
Replace radial oil seal.

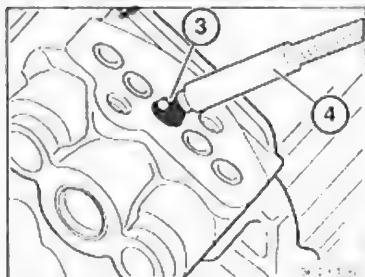
Unscrew end cover (1).



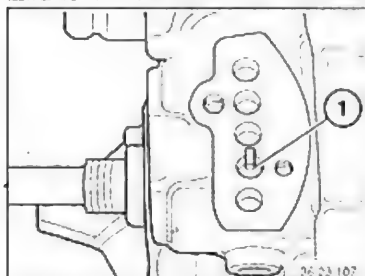
23-454



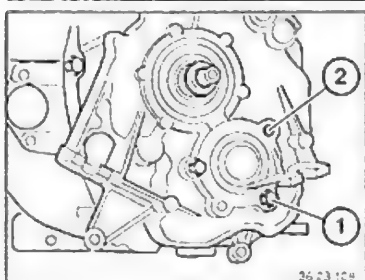
Remove springs (1) and pins (2).



Remove arresting and locking balls (3) with help of magnet (4).

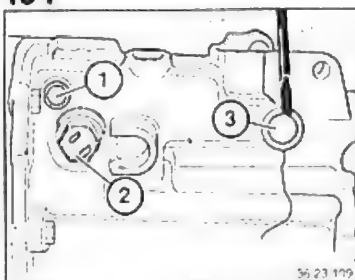


Position lock pin (1) in the middle.
To hold in this position the second gear must be engaged by hand.

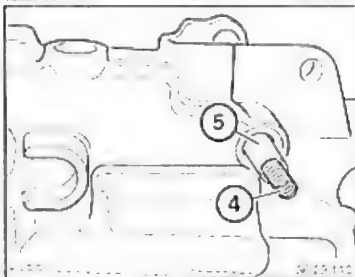


Unscrew four bolts (1) from cover.

Important!
Pay attention to insulators (2) under heads of bolts.

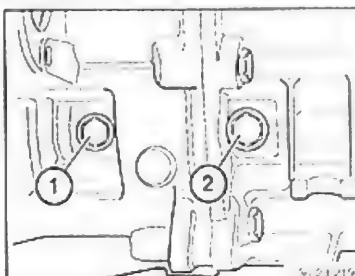


Unscrew bolt (1) and reverse gear switch (2).
Lever out end cap (3).

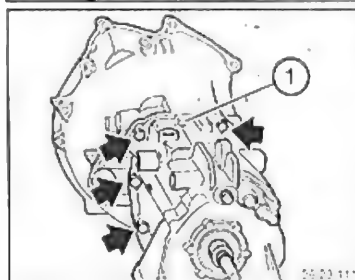


Remove spring (4) and catch pin (5).

Installation:
Check installed position.

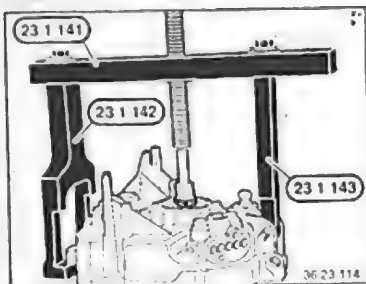


Unscrew reverse gear shaft mounting bolts (1 and 2).

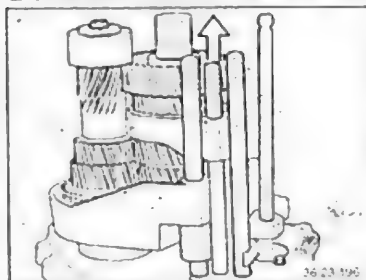


Loosen transmission case bolts.
Drive out two cylindrical pins (1) with a mandrel.

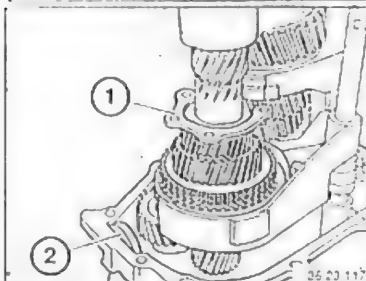
23-455



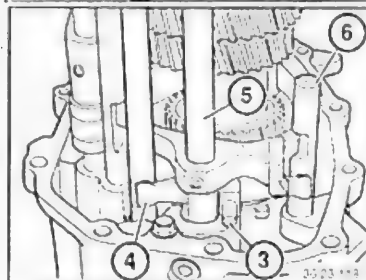
Remove transmission from Special Tool 00 1 490 and turn transmission to have it standing upright. Mount Special Tool 23 1 141 on lower case section with help of Special Tools 23 1 142 and 23 1 143. Pull off rear case section.



Disengage second gear by hand (neutral).

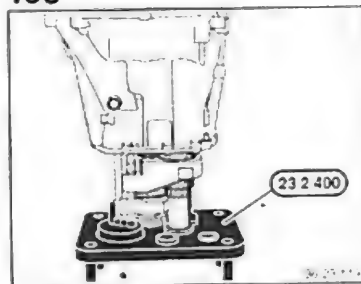


Remove holder (1) and magnet (2).

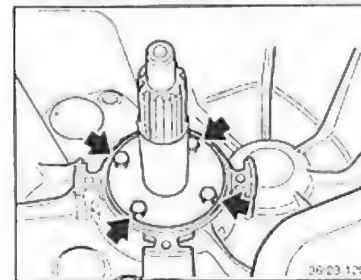


Remove shaft pin (3) and reversing lever (4). Take off shift rail (6). Pull out shift shaft (5).

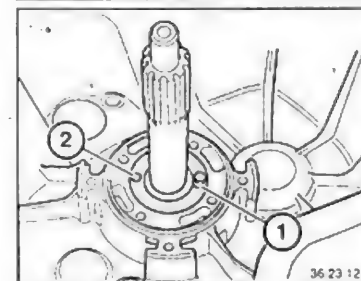
Important!
Rollers.



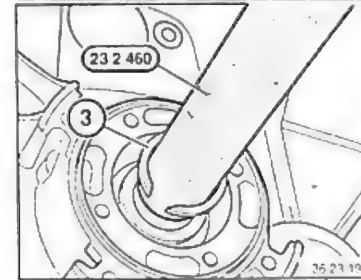
Place gear assembly set and front case section on Special Tool 23 2 400.



Unscrew guide tube.



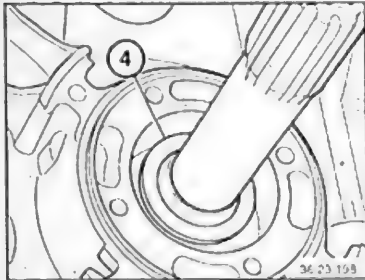
Remove radial oil seal. Locate and puncture through bores (1 and 2) with a scriber. Drive in radial oil seal to one side as far as stop. Screw a suitable self-tapping screw into the opposite bore. Remove radial oil seal by pulling out on the self-tapping screw (use pliers).



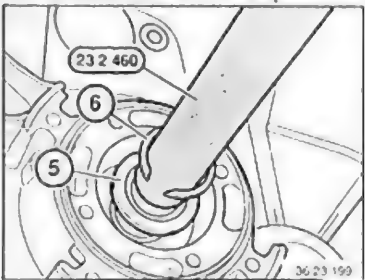
Important!
Special Tool 23 2 460 must be used on the input shaft when removing circlip (3), in order to avoid damaging the input shaft. Lift out first circlip (3) and pull off over Special Tool 23 2 460.

Installation:
Replace circlip (3).

23-456



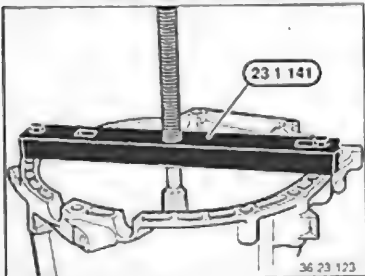
Pull off Special Tool 23 2 460.
Remove locking ring (4).



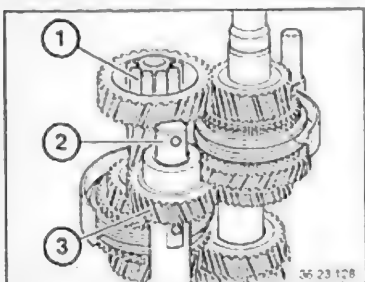
Important!
Special Tool 23 2 460 must be used on the input shaft when removing circlip (6), in order to avoid damaging the input shaft. Lift out second circlip (5) and secure to Special Tool 23 2 460. Pull Special Tool 23 2 460 with circlip (6) off of input shaft.

Installation:
Replace circlip (6).

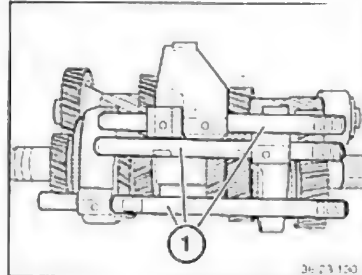
Lift out spacer (5).



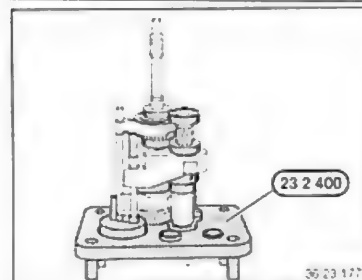
Apply Special Tool 23 1 141 on front transmission case section and secure on outside with two bolts. Pull front case section off of gear assembly set.



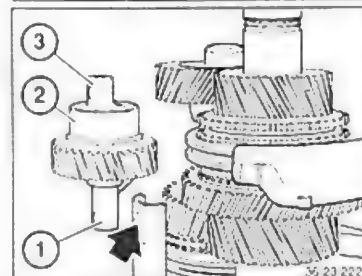
Remove roller bearing (1).
Remove reverse gear (3) and shaft (2).



Take gear assembly set with shift rods (1) off of Special Tool 23 2 400.

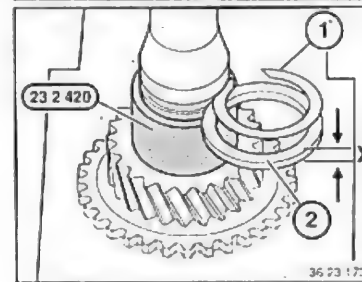


Installation:
Place complete gear assembly set with shift rods in Special Tool 23 2 400.



Install reverse gear with collar (2) facing up and shaft with long end (1) in Special Tool 23 2 400 and secure with one bolt.

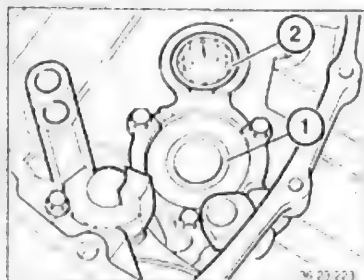
Important!
Coat outside of short end (3) of reverse gear shaft with Loctite No. 574**.



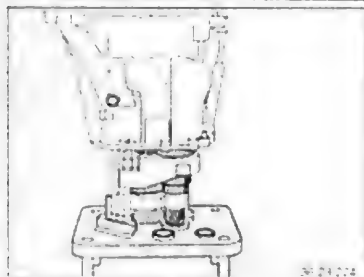
Check axial play of input shaft. Apply Special Tool 23 2 420 on input shaft. Install spacer (2) and new circlip (1) in groove. Measure axial play with a feeler gage blade. Axial play = 0.04 mm. Spacer (2) is available from Parts with thickness X of 2.3 to 2.65 mm.

** Source of Supply: BMW Parts

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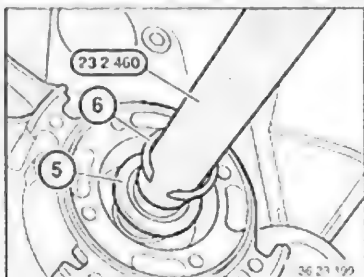


Align shift rods with each other.
Heat bearing inner race (1) of input shaft in front case section to about 110 ... 120° C (with hot air blower).
The heated temperature must be reached precisely — check with a temperature tester**.
Align shift rods with each other.
Insert roller bearing (2) after heating with viscous grease in the bearing sleeve that the large diameter end faces up.



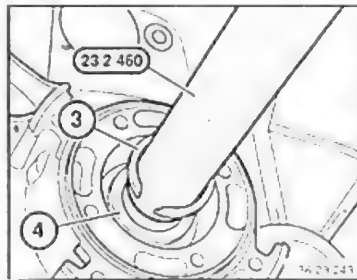
Mount front case section carefully.
Fifth gear synchromesh ring could seize.

Note!
After assembling the complete transmission the fifth gear synchromesh ring can be loosened again by turning the input or output shaft.



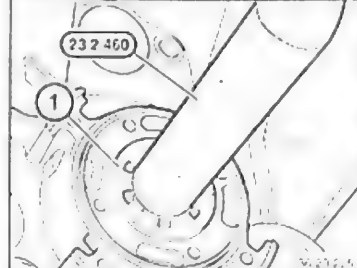
Install spacer (5).

Important!
Special Tool 23 2 460 must be used on the input shaft when installing circlip (6), in order to avoid damaging the input shaft. Slide circlip (6) over Special Tool 23 2 460 and into the second groove.



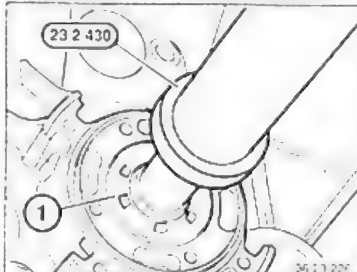
Insert locking ring (4).

Important!
Special Tool 23 2 460 must be used on the input shaft when installing circlip (3), in order to avoid damaging the input shaft. Slide circlip (3) over Special Tool 23 2 460 and into the first groove.

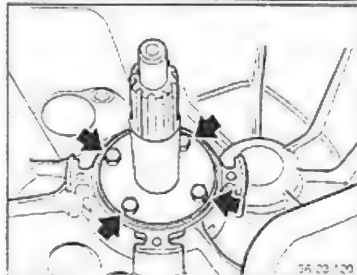


Lubricate sealing lip of radial oil seal with ATF.

Slide on radial oil seal (1) over Special Tool 23 2 460 as far as case.
Pull off Special Tool 23 2 460.



Drive in radial oil seal (1) with Special Tool 23 2 430.
Use a plastic hammer for driving in.

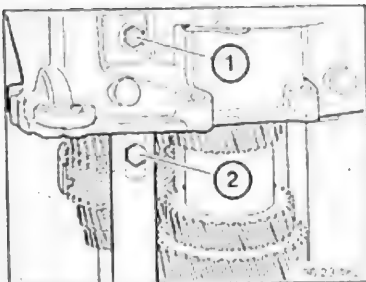


Mount guide tube.
Install bolts with bolt cement Loctite No. 242**.
Tightening torque*.

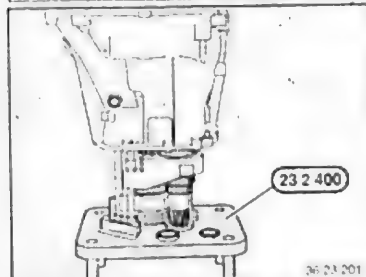
** Source of Supply: BMW Parts

* See Specifications
** Source of Supply: BMW Parts

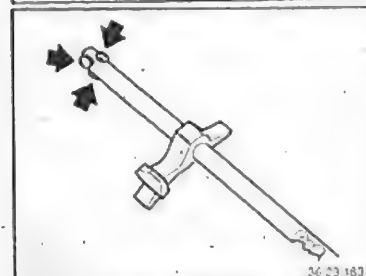
23-458



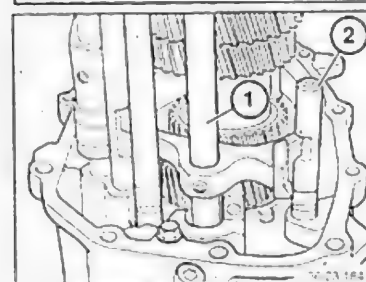
Mount reverse gear shaft on front case section.
Install bolt (1) with bolt cement Loctite No. 242** and tighten.
Tightening torque*.
Loosen bolt (2) on Special Tool 23 2 400.



Take front case section with gear assembly set off of Special Tool 23 2 400.
Position front case section with gear assembly set upright.

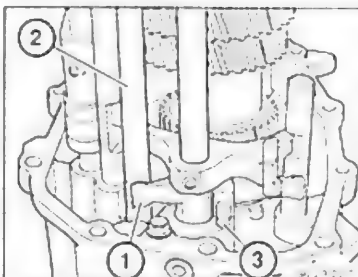


Hold four rollers on the shift shaft with help of grease.

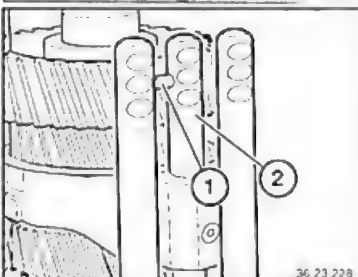


Place shift shaft (1) in front case section.
Install shift rail (2) with opening facing up towards case.

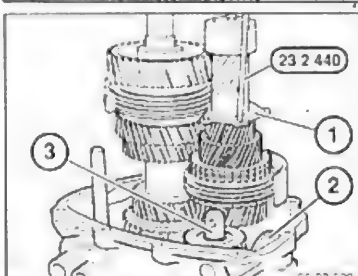
* See Specifications
** Source of Supply: BMW Parts



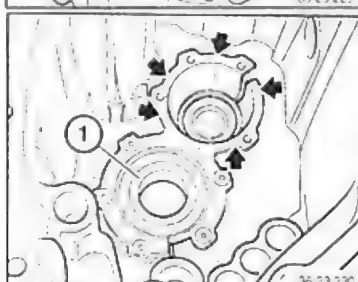
Install reversing lever with large round surface (1) facing 1st/2nd gear shift rod (2).
Ground surface must point towards case.
Hold reversing lever in position with pin (3).



Install lock pin (1) lubricated with grease in 1st/2nd gear shift rod (2) and secure in the middle.



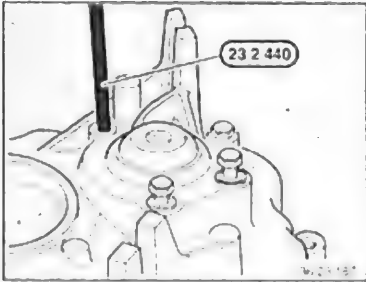
Clean and coat case sealing surfaces with Loctite No. 574**.
Mount holder (1) on 2nd gear of the layshaft with the straight end pointing towards the bearing.
Special Tool 23 2 440 must be screwed in for later assembly work.
Place magnet (2) in opening.
Align shift rods with each other.
Coat outside of reverse gear shaft (3) with Loctite No. 574**.



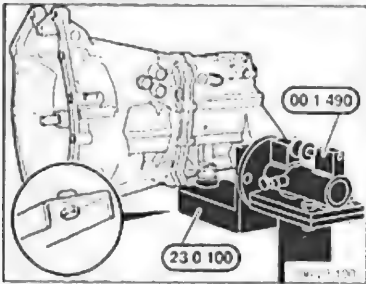
Remove radial oil seal for shift shaft.
Heat bearing inner race (1) and rear case section in area of bearing to 110 ... 120° C (with hot air blower).
The heated temperature must be reached precisely — check with a temperature tester**.

** Source of Supply: BMW Parts

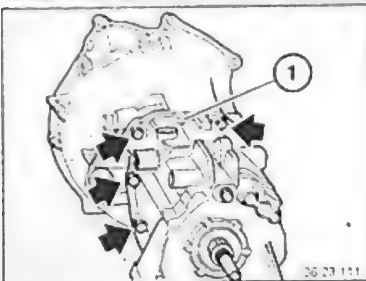
23-459



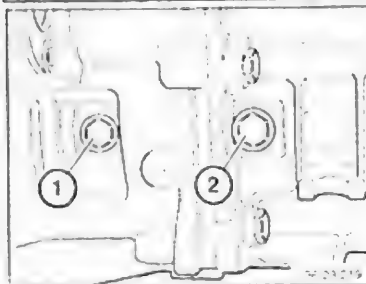
Mount rear case section as far as stop.
Install three bolts with new seals.
Remove Special Tool 23 2 440.
Screw in fourth bolt with a new seal.
Tighten all bolts.
Tightening torque*



Lightly secure front and rear case sections
with two bolts located opposite each other.
Take up transmission in Special Tools
23 0 100 and 00 1 490 again.

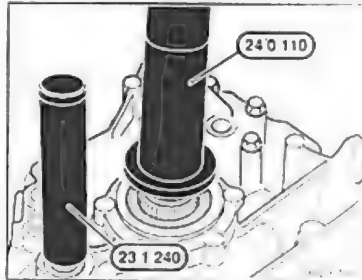


Drive in dowel pins (1).
Screw in and tighten all case bolts.
Tightening torque*.

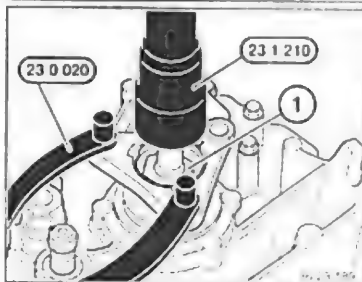


Loosen bolt (1) slightly.
Install reverse gear shaft bolt (2) with bolt
cement Loctite No. 242**.
Tighten bolts (1 and 2).
Tightening torque*.

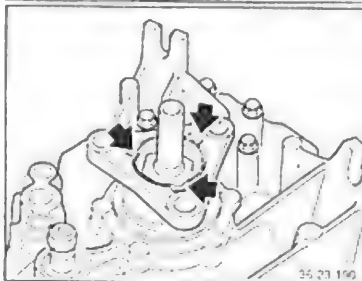
* See Specifications
** Source of Supply: BMW Parts



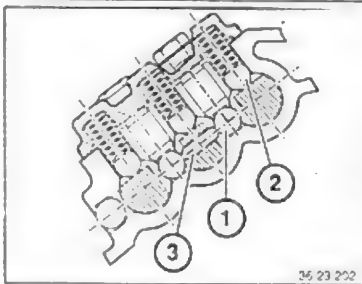
Install radial oil seals for shift shaft and
output shaft.
Coat sealing lips with ATF.
Drive in radial oil seal for output shaft with
Special Tool 24 0 110 and radial oil seal for
shift shaft with Special Tool 23 1 240.
Use a plastic hammer for driving in.



Heat output flange to about 80° C (with hot
air blower) and install on output shaft,
driving on to fit tight if necessary.
Install collar nut (1) with bolt cement Loc-
cite No. 242**.
Hold output flange with Special Tool
23 0 020.
Tighten collar nut with Special Tool
23 1 210.
Tightening torque*.



Install and secure lock plate.



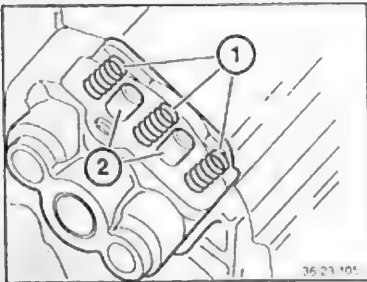
Install arresting and locking balls.

1 = Locking ball
2 = Arresting ball
3 = Lock pin

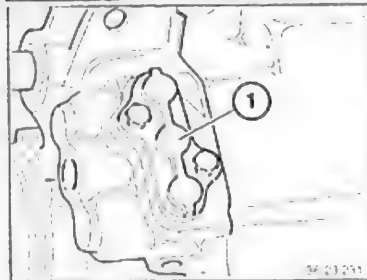
* See Specifications
** Source of Supply: BMW Parts

23-460

Install springs (1) and dowel pins (2).

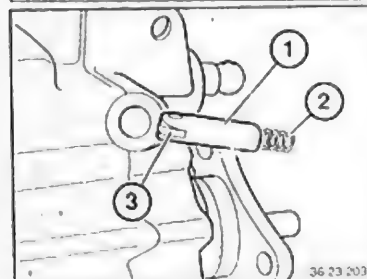


Mount end cover (1).
Install bolts with bolt cement Loctite No. 242** and tighten.
Tightening torque*.

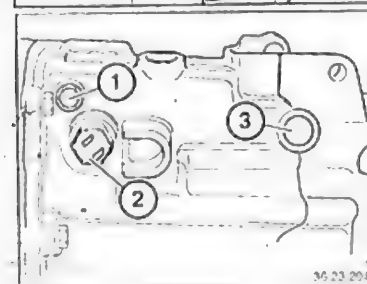


Install catch pin (1) and spring (2).

Important!
Roller (3) must be horizontal in direction of shifting.



Install bolt (1) with bolt cement Loctite No. 242** and tighten.
Screw in reverse gear switch (2).
Tightening torque*.
Drive in end cap (3).



- * See Specifications
- ** Source of Supply: BMW Parts

23-461

23 21 706 REPLACING BEARINGS OF ALL TRANSMISSION SHAFTS - Input and Output Shafts Removed -

Rear Case Section - Output Shaft Bearing:

Take up rear case section on Special Tools 23 0 100 and 00 1 490.

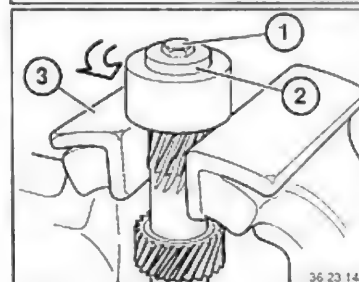
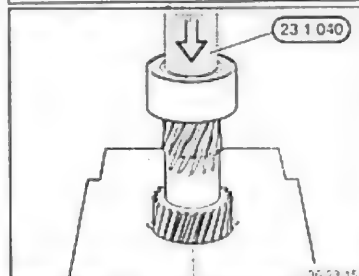
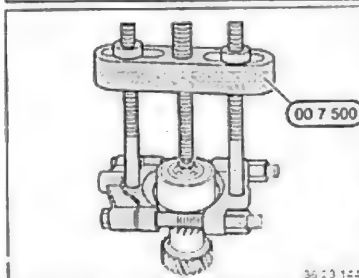
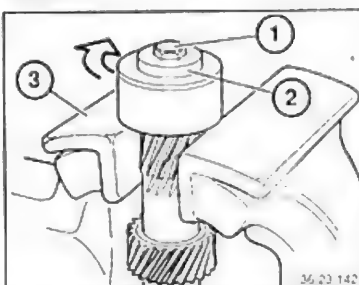
Unscrew holder (2).
Remove oil scraper plate (1) if installed.

Installation:
Also secure oil scraper plate (1).
Install bolts with bolt cement Locite No. 242**.
Tightening torque*.

Drive out output shaft bearing from outside to inside with Special Tools 23 1 340 and 00 5 500.

Heat rear case section in area of bearing for output shaft to about 80° C (with hot air blower).
Install bearing, driving it in to fit tight with help of Special Tools 23 2 450 and 00 5 500 if necessary.

* See Specifications
** Source of Supply: BMW Parts



Layshaft Bearing:

Clamp layshaft in a vise fitted with two soft jaws (3).
Remove bolt (1).

Important!
Left-hand threads.

Remove washer (2).
Take layshaft out of vise.

Installation:
Bolt (1) must be replaced.

Pull ball bearing off of layshaft with Special Tool 00 7 500.
This requires screwing in the mounting bolt without washer again.

Important!
Bolt has left-hand threads.

Heat bearing inner race to about 80° C (with hot air blower) and install on layshaft; if necessary press it on with help of Special Tool 23 1 040.

Clamp layshaft in a vise fitted with two soft jaws (3) again to tighten bolt (1).
Install washer (2).
Install new bolt (1) with bolt cement Locite No. 242** and tighten.
Tightening torque*.

* See Specifications
** Source of Supply: BMW Parts

23-462

Front Case Section - Input Shaft Bearing:

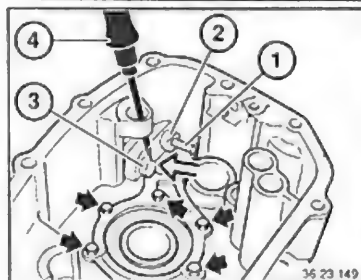
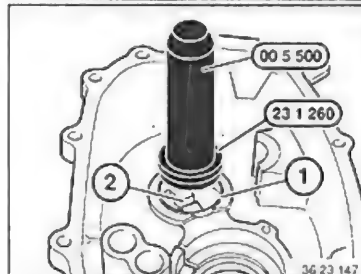
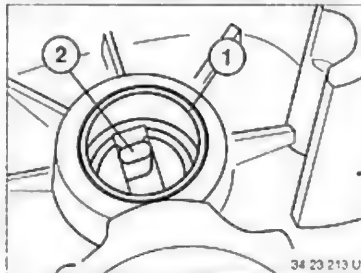
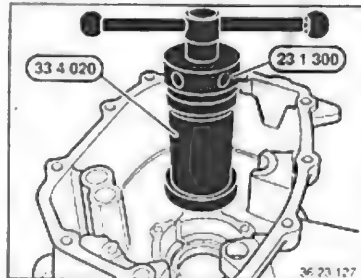
Remove selector arm (1). This is done by unscrewing bolts (4 and 5) and then removing console (3), spring (2) and selector arm (1). Unscrew holder (6).

Drive out bearing from inside to outside with Special Tools 23 1 340 and 00 5 500.

Heat front case section in area of bearing to about 80° C (with hot air blower). Install bearing; if necessary drive it in to fit tight with help of Special Tools 23 1 470 and 00 5 500.

Layshaft Bearing:

Place Special Tool 23 1 280 in bearing shell (1).



Apply Special Tool 33 4 020. Screw on Special Tool 23 1 300. Pull out bearing shell.

Installation: Install bearing shell (1) that slot in bearing shell is aligned with anti-turning bead (2) in case.

Drive in bearing shell (1) with Special Tools 23 1 260 and 00 5 500.

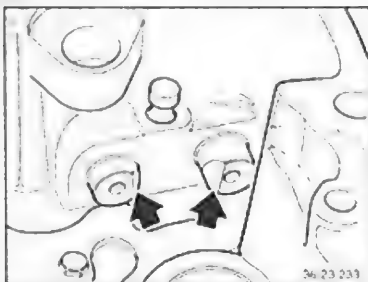
2 = Anti-turning bead (2)

Install holder as follows. Push lock pin (2) towards outside with bolt (1). Push lock pin (3) towards outside with screwdriver (4). Install holder and secure with bolts. Install bolts with bolt cement Loctite No. 242**. Tightening torque*. Remove bolt (1).

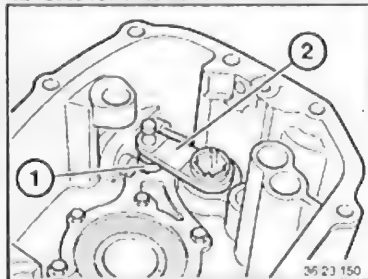
* See Specifications
** Source of Supply: BMW Parts

23-463

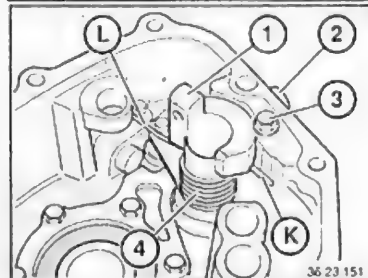
Check installed position of pressure pins.
Bevelled surfaces must point inwards
towards each other.



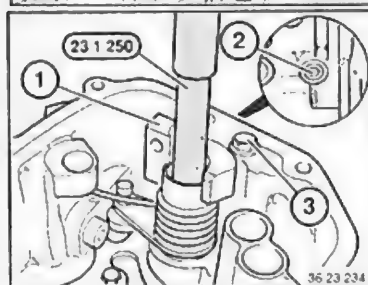
Install roller (1) with selector arm (2).



Install spring (4) and sleeve (1).
Attach short arm (K) of spring on case and
long arm (L) in groove of selector arm.
Coat head of bolt (2) with Loctite No. 574**
on inside.



For easier installation (strong spring force)
apply Special Tool 23 1 250 in selector arm
and press sleeve (1) towards case.
In this position install bolt (2) with bolt ce-
ment Loctite No. 242** and tighten lightly.
Tighten bolt (2) to final torque last.
Tightening torque*.



- * See Specifications
- ** Source of Supply: BMW Parts

23-464

23 23 500 DISASSEMBLING AND ASSEMBLING COMPLETE SYNCHRONIZATION

Remove input and output shaft assembly - refer to 23 21 505.
Remove gear assembly set with shift rods from Special Tool 23 2 400.

Pull off shift rods (1).
Remove layshaft from gear assembly set.

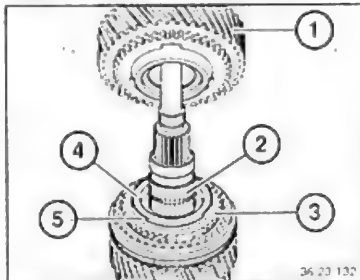
Pull off input shaft, needle bearing (1) and 5th gear synchromesh ring.

For easier installation, place output shaft in Special Tool 23 2 400.
Pull 5th/reverse gear operating sleeve (2) off of guide sleeve.

Important!
Loose thrust pieces, balls and springs.

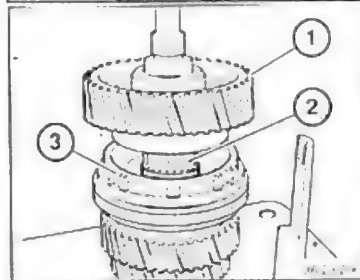
Lift out circlip (1).

Installation:
Replace circlip.

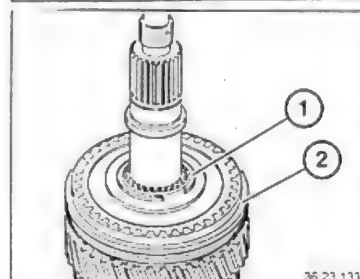


Turn output shaft around so that output end faces up.

Double Taper Synchronization:
Pull 1st gear (1), needle bearing (2), synchromesh ring (3), conical ring (4), and friction ring (5) off of output shaft.



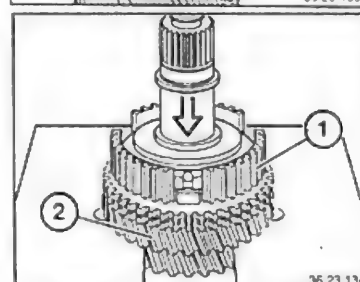
Single Taper Synchronization:
Pull 1st gear (1), needle bearing (2) and synchromesh ring (3) off of output shaft.



Lift out circlip (1).
Pull off 1st/2nd gear operating sleeve (2).

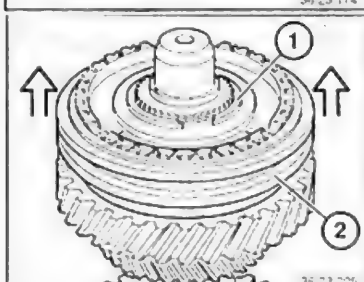
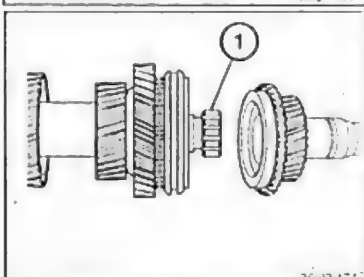
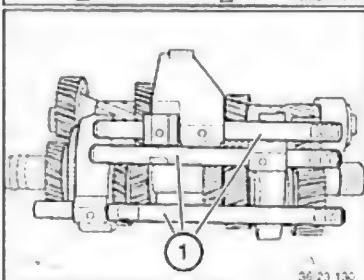
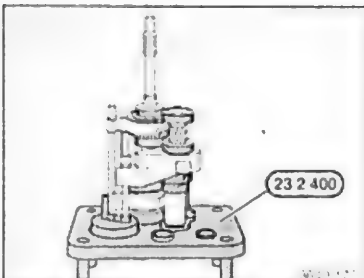
Important!
Loose thrust pieces, balls and springs.

Installation:
Replace circlip (1).

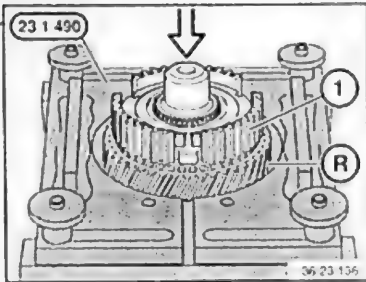


Press 2nd gear (2) and guide sleeve (1) off of output shaft.
Pressing-off force*.

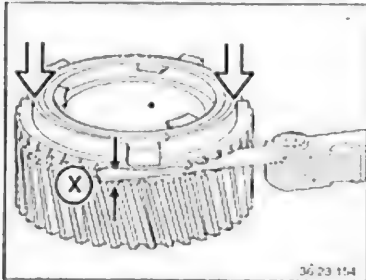
* See Specifications



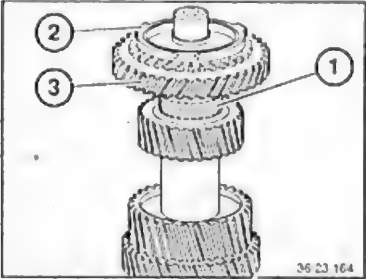
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Using Special Tool 23 1 490, press reverse gear, synchromesh ring and guide sleeve (1) off of output shaft. Pressing-off force*.

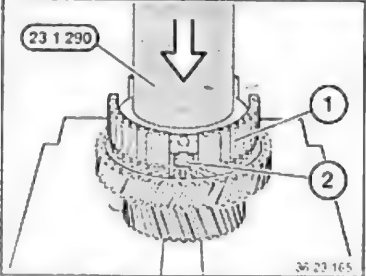


Inspect all synchronization components for wear prior to assembling the gear assembly set. Also determine gap X between synchromesh ring and concerned gears. Measure in area of stops. Press synchromesh ring uniformly in direction of the taper. Gaps* of different gears.



Assembling Gear Assembly Set.
Install needle bearing (1), reverse gear (3) and synchromesh ring (2).

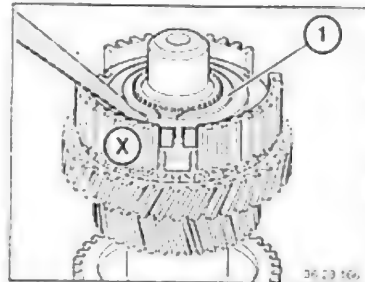
Note:
Lightly lubricate bearing surfaces on needle bearing (1) and synchromesh ring (2) with ATF.



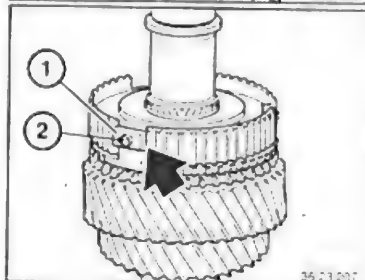
Heat 5th/reverse gear guide sleeve (1) to about 120° C (with hot air blower) and install on output shaft; if necessary press on to fit tight with help of Special Tool 23 1 290.

Important!
Make sure that stops (2) engage in opening of the guide sleeve while pressing on. Pressing-on force*.

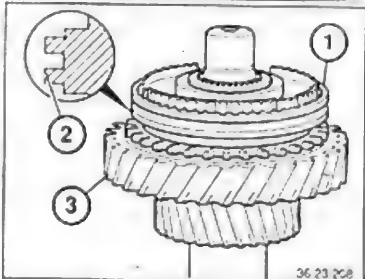
* See Specifications



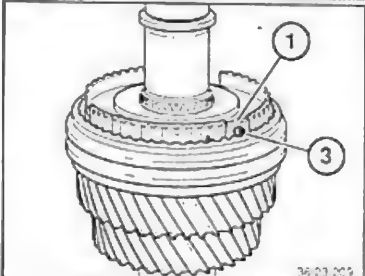
Install suitable circlip (1). Circlips are available from Parts in thicknesses from 2.0 to 2.3 mm in steps of 0.05 mm. Max. premissible axial play X = 0.04 mm.



Place three thrust pieces (1) with bevels facing out and springs (2) in opening of guide sleeve.

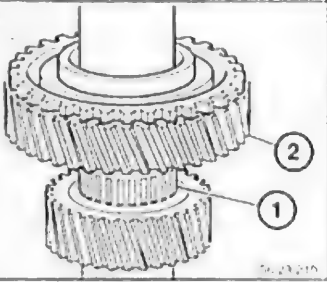


Mount operating sleeve (1) with identification groove (2) facing reverse gear (3).



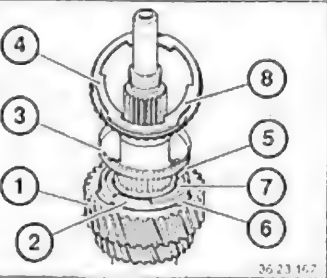
Tilt thrust pieces (1) out of operating sleeve separately far enough that balls (3) can be placed on the springs. Press balls (3) towards inside and simultaneously press thrust pieces into the operating sleeve. Place 5th gear synchromesh ring in the operating sleeve. Pull operating sleeve upwards uniformly as far as lock (neutral position).

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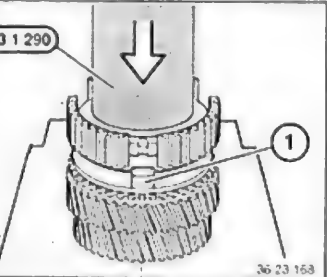
Turn output shaft around so that the output end faces up.
Install needle bearing (1) and 2nd gear (2) on output shaft.

Note:
Lubricate bearing surfaces on needle bearing with ATF.



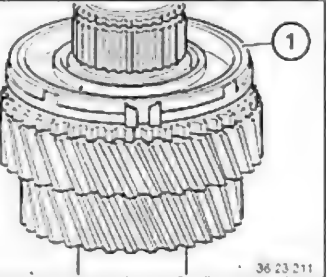
Double Taper Synchronization:

Important!
The complete synchronization must be replaced when it is necessary to replace 1st/2nd gear synchronization.
Install conical ring (2), friction ring (3) and synchronizer ring (4) in such a manner that tabs (5) of friction ring engage in opening (6) of 2nd gear (1).
Tabs (8) on synchronizer ring (4) engage in opening (7).



Heat 1st/2nd gear guide sleeve to about 120° C (with hot air blower) and install on output shaft; if necessary press on to fit tight with help of Special Tool 23 1 290.

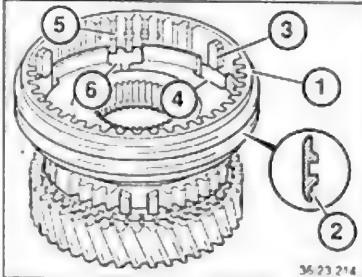
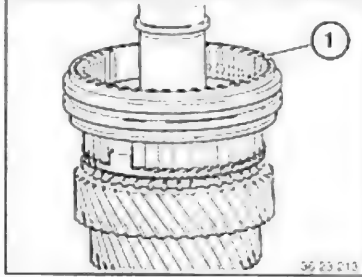
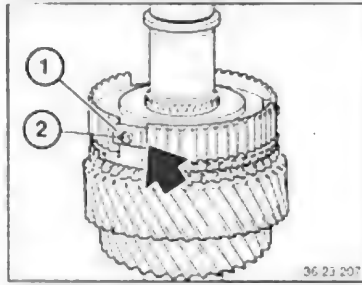
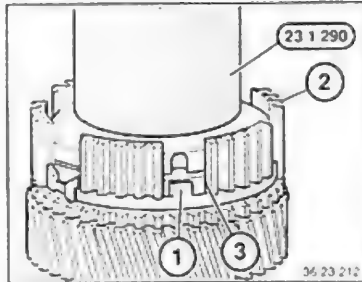
Important!
Make sure that stops (1) engage in opening of the guide sleeve while pressing on. Pressing-on force*.



Single Taper Synchronization:

Install synchronizer ring (1).

* See Specifications



Single Taper Synchronization:

Heat 1st/2nd gear guide sleeve to about 120° C (with hot air blower).
Install guide sleeve that stops (1) point towards opening (3) of guide sleeve (2).
Press on guide sleeve (2) to fit tight with Special Tool 23 1 290.
Make sure that stops (1) engage in opening of the guide sleeve while pressing on. Pressing-on force*.

Insert three thrust pieces (1) with bevel facing out and three springs (2) into opening of guide sleeve.

Double Taper Synchronization:

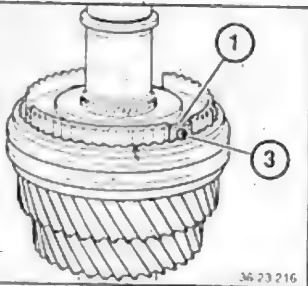
Install operating sleeve (1).

Single Taper Synchronization:

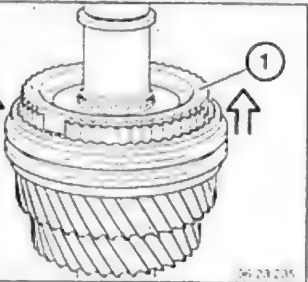
Install operating sleeve (1) with identification groove (2) pointing towards 2nd gear.
Tab (3) on operating sleeve faces center of opening (4) or teeth with grooves (5) towards opening (6) of slides.

* See Specifications

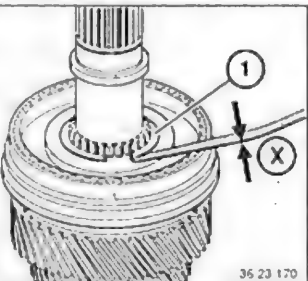
23-467



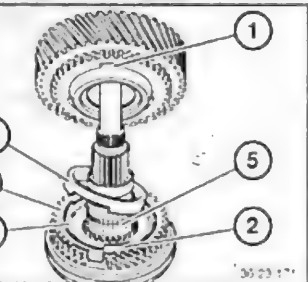
Tilt thrust pieces (1) out of operating sleeve separately far enough that balls (3) can be placed on the springs. Press balls (3) towards inside and simultaneously press thrust pieces into the operating sleeve.



Place 1st gear synchromesh ring (1) into openings of guide sleeve. Pull up operating sleeve uniformly as far as lock (neutral position).



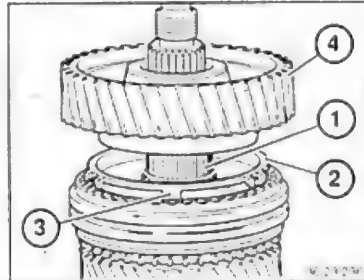
Install suitable circlip (1). Circlips are available from Parts in thicknesses from 2.0 to 2.3 mm in steps of 0.05 mm. Max. permissible axial play $X = 0.04$ mm.



Double Taper Synchronization:

Install needle bearing (5). Insert synchromesh ring (6), friction ring (4) and conical ring. Mount 1st gear.

Important!
Tab (3) must engage in opening (4) and tab (2) in opening (1). Lubricate bearing surfaces on needle bearing and synchromesh ring with ATF.

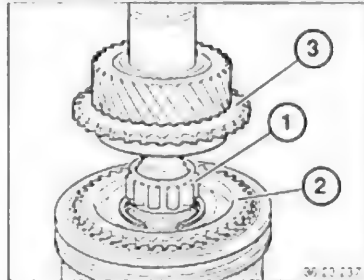


Single Taper Synchronization

Install needle bearing (1). Install synchromesh ring (2) with tabs (3) facing the slides.

Note:
Lubricate bearing surfaces on needle bearing and synchromesh ring with ATF.

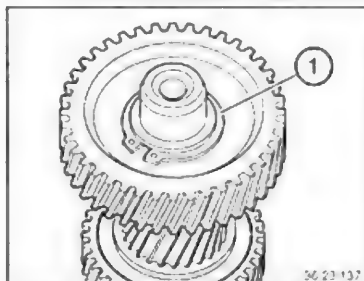
Install 1st gear (4).



Install roller bearing (1), 5th gear synchromesh ring (2) and input shaft on output shaft (3).

Note:
Lubricate bearing surfaces on needle bearing and synchromesh ring with ATF.

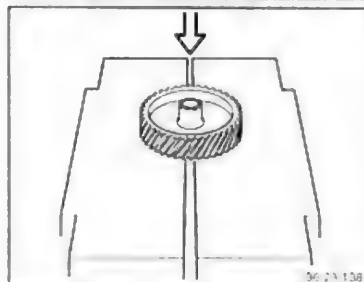
Lift input and output shaft assembly off of Special Tool 23 2 400 and lay aside.



Layshaft

3rd/4th gear synchronization: Place layshaft in Special Tool 23 2 400 to install synchronization. Lift out circlip (1).

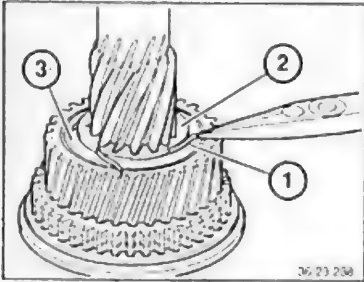
Installation:
Replace circlip (1).



Take up layshaft in a press. Select bearing surface on constant gear as large as possible. Press constant gear off of layshaft. Pressing-off force*.

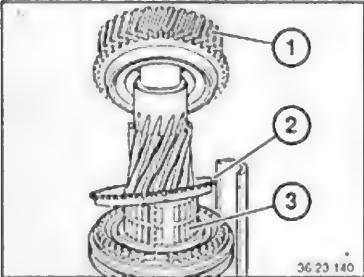
* See Specifications

23-468

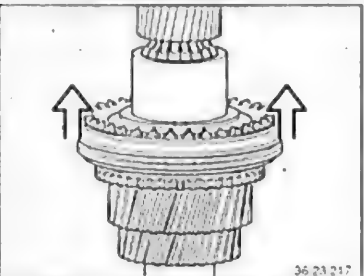


Remove locking ring (1) after unbending four tabs towards outside with a pliers. Remove support (2) (two parts) and thrust washer (3).

Installation:
Replacing locking ring (1).

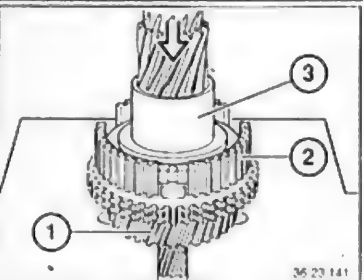


Remove 4th gear (1), synchronesh ring (2) and needle bearing (3).



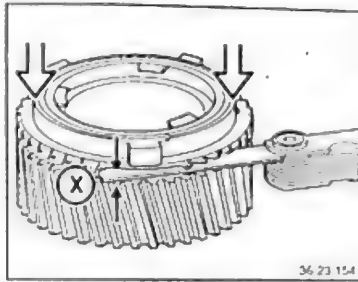
Pull off 3rd/4th gear operating sleeve upwards.

Important!
Loose thrust pieces, balls and springs.

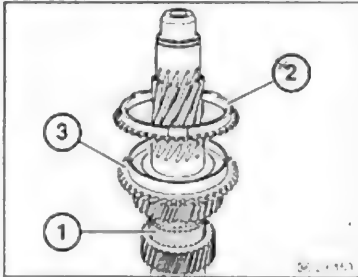


Take up layshaft in a press. Press 3rd gear (1), guide sleeve (2) and bearing sleeve (3) off of layshaft. Pressing-off force*.

* See Specifications

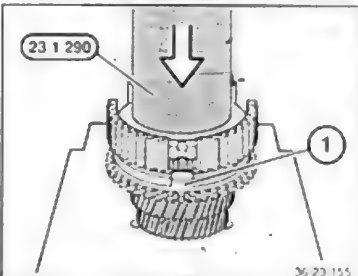


Inspect components of synchronization for wear prior to assembling. Measure gap X between synchronesh ring and concerned gears for this purpose. Measure in area of stops. Press synchronesh ring uniformly in direction of taper. Gap* of different gears.



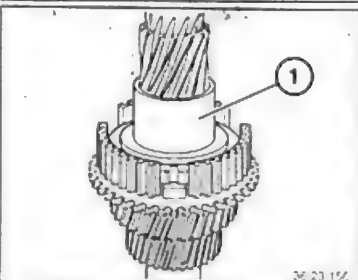
Install needle bearing (1), 3rd gear (3) and synchronesh ring (2).

Note:
Lubricate bearing surfaces on needle bearing and synchronesh ring with ATF.



Heat guide sleeves to about 120° C (with hot air blower) and install on layshaft. Install 3rd/4th gear guide sleeve and press on to fit tight with help of Special Tool 23 1 290.

Important!
Make sure that stops (1) engage in opening of guide sleeve while pressing on. Pressing-on force*.



Heat bearing inner race (1) to about 80° C (with hot air blower) and push on to layshaft as far as stop.

* See Specifications

23-469

Place three thrust pieces (1) with bevel facing out and three springs (2) in opening of guide sleeve.

Install operating sleeve (1) with groove (2) pointing towards 3rd gear (3). Three ground out teeth (4) must point towards springs (5) or slides.

Tilt thrust pieces (1) out of operating sleeve separately far enough that balls (3) can be placed on the springs. Press balls (3) towards inside and simultaneously press thrust pieces into the operating sleeve. Place 3rd gear synchromesh ring in the operating sleeve. Pull up operating sleeve uniformly as far as the lock (neutral position).

Install needle bearing (1), synchromesh ring (2) and 4th gear (3) on layshaft.

Note:
Lubricate bearing surfaces on needle bearing and synchromesh ring with ATF.

Install thrust washer (1) over splines as far as the bearing surface.

Install support (two parts) with small diameter (1) pointing down in groove. The axial play must be adjusted after replacing the support.
Max. axial play = 0.04 mm.
Supports are available from Parts in thicknesses from 2.9 to 3.15 mm in steps of 0.05 mm.

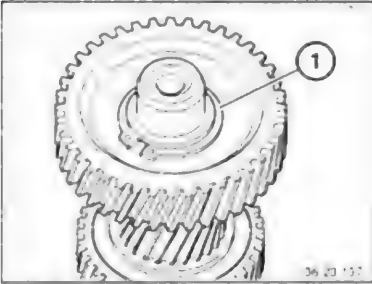
Apply Special Tool 23 2 410 on layshaft. Clip in locking ring (1) with the four tabs in groove (3).

Heat constant gear to about 180° C (with heating plate). Check temperature with temperature tester**. Place layshaft in a press. Install constant gear on layshaft and press on to fit tight with Special Tool 23 1 290. Pressing-on force*.

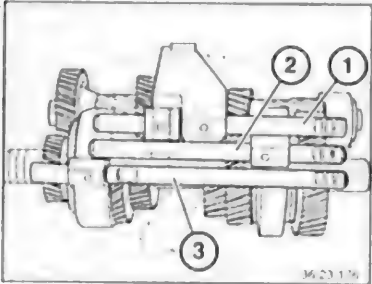
* See Specifications
** Source of Supply: BMW Parts

23-470

Install circlip (1).



Assemble layshaft with input shaft and output shaft.
Install 3rd/4th gear shift rod (1), 1st/2nd gear shift rod (2) and 5th/reverse gear shift rod (3).

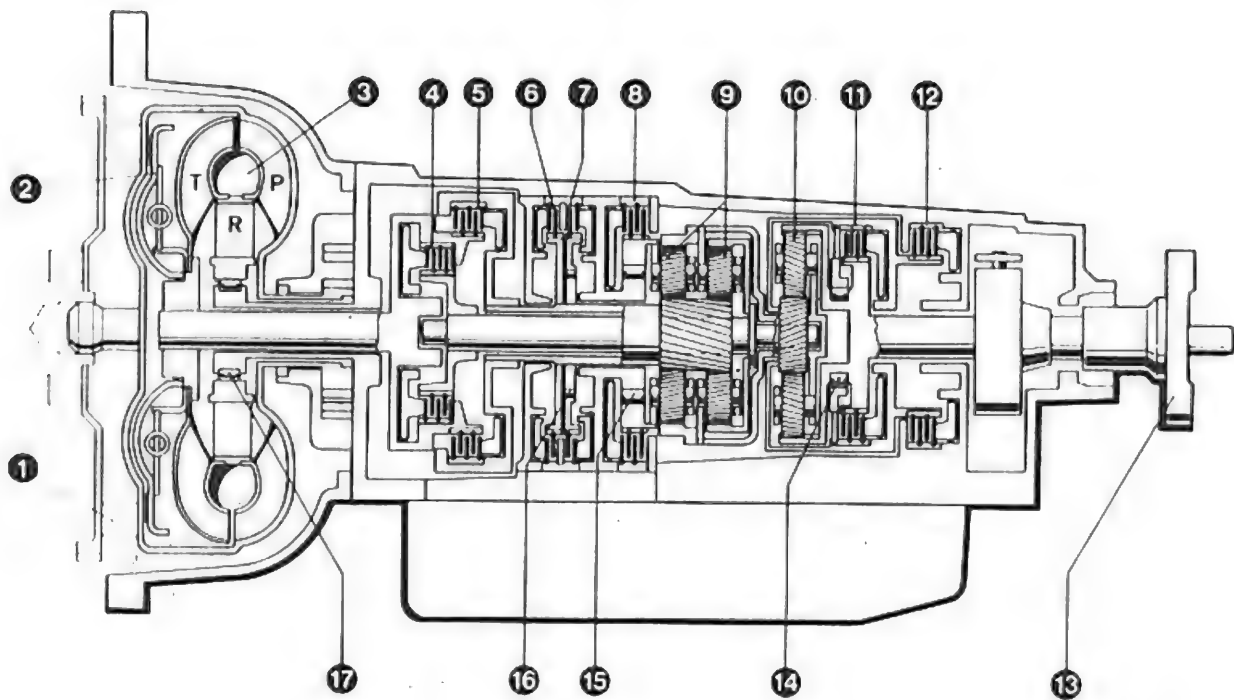


Construction group 24 Automatic transmission

4 HP-22/24

	Assembly drawing	24-	150
	Power flow diagrams	24-	151
24 00 082	Transmission – disassemble and assemble	24-	155
24 12 003	Radial oil seal for torque converter – replace	24-	161a
24 16 502	Transfer plate – replace	24-	161b
24 23 022	Plate clutches and brakes – replace	24-	162
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24-150



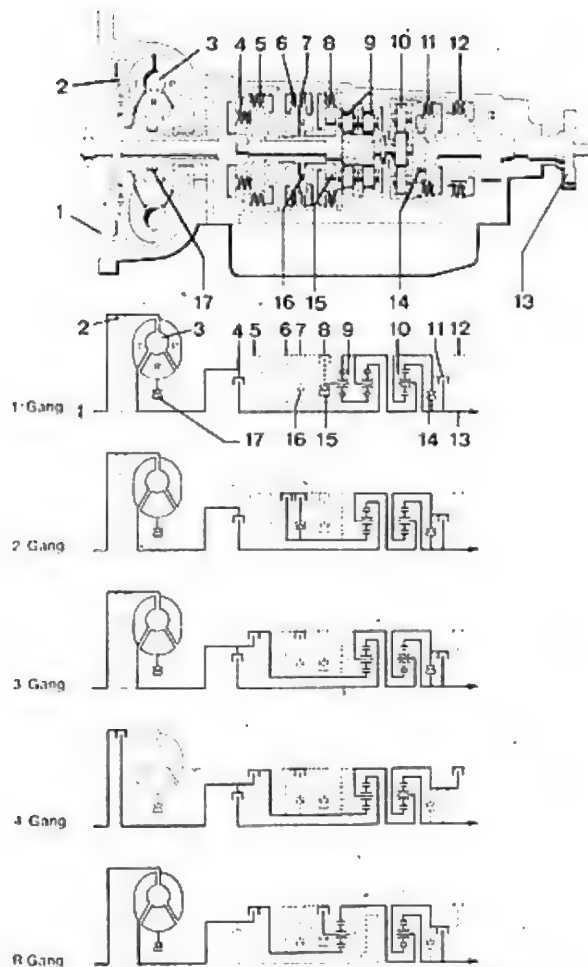
733 24 063

4 HP -22/24 Assembly Drawing

- | | | | |
|---------------------------------|-------------|-------------------------------|-------------------|
| 1 Input | 4 Clutch A | 9 Planet gear set | 14 One-way clutch |
| 2 Converter lockup clutch | 5 Clutch B | 10 Planet gear set - 4th gear | 15 One-way clutch |
| 3 Hydrodynamic torque converter | 6 Clutch C' | 11 Clutch E | 16 One-way clutch |
| P = Impeller | 7 Clutch C | 12 Clutch F | 17 One-way clutch |
| R = Stator | 8 Clutch D | 13 Output | |
| T = Turbine | | | |

24-151

4 HP-22/24 Power Flow Diagrams

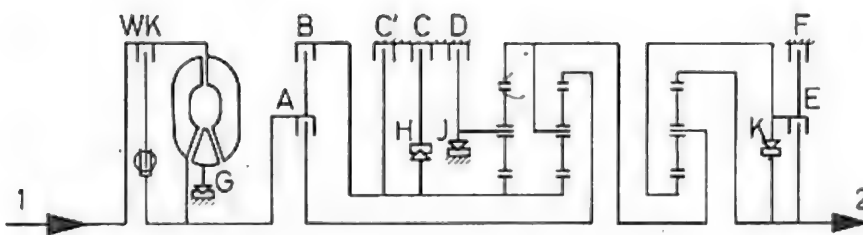


733 24 062

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4 HP -22/24 Transmission Layout

- 1 Input
 2 Output
 WK Converter lockup clutch
 A ... F Clutches
 G ... K One-way clutches



635 24 013

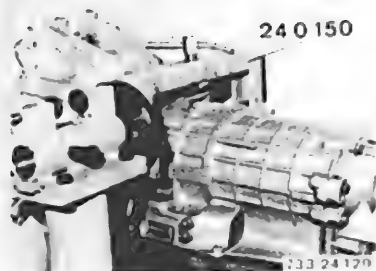
4 HP - 22 / H + EH Closed Shift Elements 4 HP-24/EH

- WK = Converter lockup clutch
 RS = Reverse gear lock
 X = Activated clutches and brakes
 (X) = Depending on operating state
 *) = Only with EH
 + = Activated solenoid valve
 (+) = Depending on operating state
 / = Solenoid valve without current

Gear	Clutch			Brake				One-way Clutch				WK	Solenoid Valve*)			
	A	B	E	C'	C	D	F	G	H	J	K		WK	RS	1	2
1st	X		X			(X)		(X)		X	X				+	+
2nd	X		X	X	X			(X)	X		X				/	+
3rd	X	X	X		X			(X)			X	(X)	(+)		/	/
4th	X	X			X		X	(X)				(X)	(+)		+	/
R		X	X			X		(X)						+	+	+

24 -155

24 0 150



24 00 082 DISASSEMBLING AND ASSEMBLING TRANSMISSION

Remove transmission – see 24 00 022 In Model Repair Manual from 1985 models on.

Note:

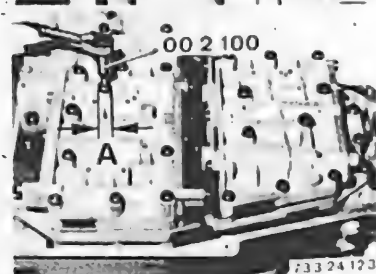
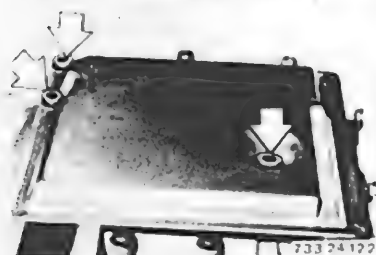
Stronger 4 HP-24 automatic transmission is included in the following scope. 4 HP-24 transmission is mentioned when procedures are different. Torque converter is removed. Mount transmission on Special Tool 24 0 150 In Special Tool 00 1 490.

Caution!

Tighten bolts only finger tight to avoid distorting the transmission case.

A) Disassembling

Unscrew oil sump.
Unscrew oil filter screen.
Unscrew Torx bolts with Special Tool 00 2 100.



Unscrew valve body.
Unscrew Torx bolts with Special Tool 00 2 100.

Important!

Only unscrew bolts with head size A = 12 mm (0.472"). The socket for the transmission wire harness must be removed for the EH version.



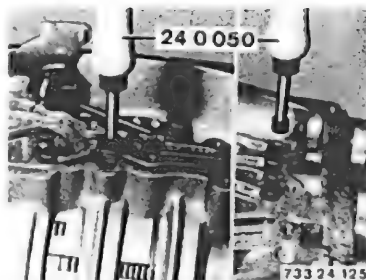
Lift out eight circlips.
Remove eight springs.

Installation:

Install long springs for the output.

EH Transmission:

Only three circlips and three springs have to be removed for cylinder F (output end).



Pull out eight sealing sleeves with Special Tool 24 0 050.

EH Transmission:

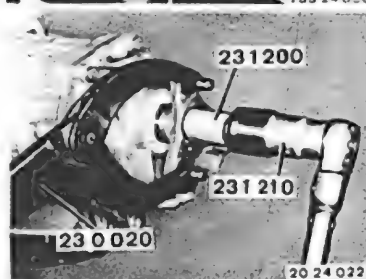
Only remove three sealing sleeves for cylinder F (output end).



Important!

Lubricating oil supply for cylinder F gear set was improved gradually since 7.85.

Circlip (2), spring (3) and sealing sleeve (4) must be removed at bore (1) additionally when assembling. Pull sealing sleeve (4) out of the bore with a M 6 x 65 bolt. Cant bolt slightly for this purpose.

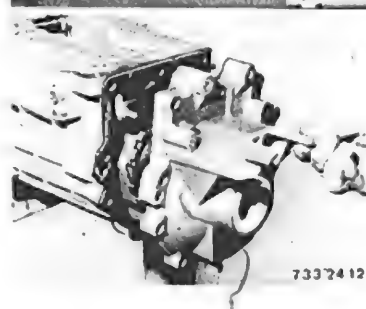


Lift off lockplate.

Use Special Tool 23 1 200 only for the version with a three-hole flange. Hold output flange with Special Tool 23 0 020.

Unscrew collar nut with Special Tool 23 1 210.

Pull off output flange.

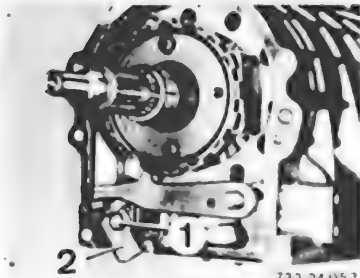


Unscrew transmission extension.

Installation:

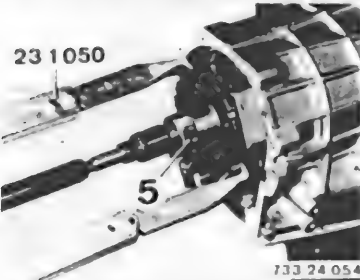
Replace gasket.

24-156



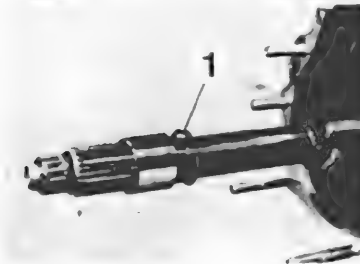
733 24 053

Loosen screw (1) enough with Special Tool 00 2 100 that bracket (2) can be folded down. Remove parking lock pawl, spring and bearing pin.
Caution!
Spring force.

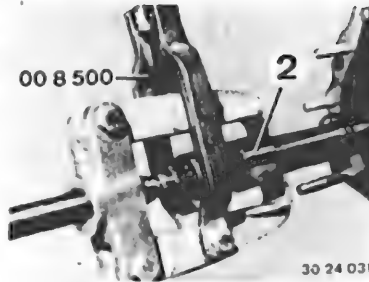


733 24 054

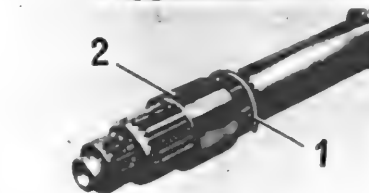
Pull off parking lock gear with regulator.
Note:
Check axial shim between output flange and parking lock gear.
Version with Spacer (5):
The parking lock gear must be pulled off with Special Tool 23 1 050.



Version with Transfer Box:
Lift out and slide snap ring (1) forward.
Installation:
Replace snap ring.



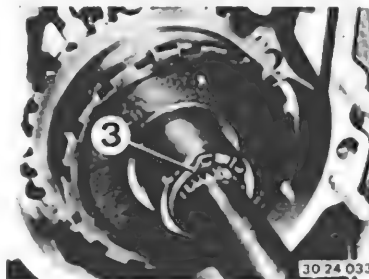
30 24 031



30 24 032

Pull bearing sleeve (2) off of the input shaft with Special Tool 00 8 500.

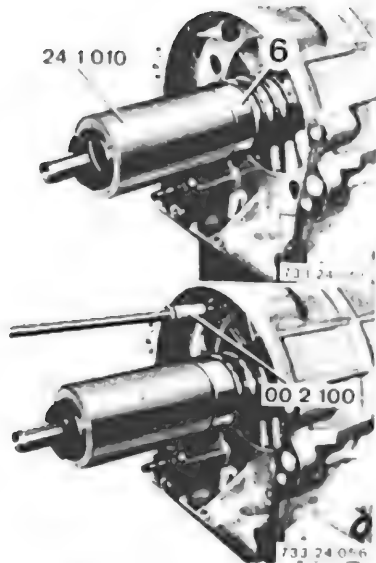
Installation:
Install snap ring (1) in groove of output shaft. Heat bearing sleeve (2) to approx. 80° C (175° F) with a hot air blower and slide it on to the output shaft against snap ring (1).



30 24 033

Lift out circlip (3).
Pull off parking lock gear with regulator.

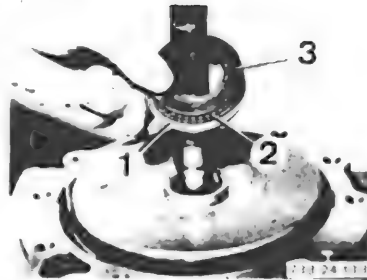
24-156a



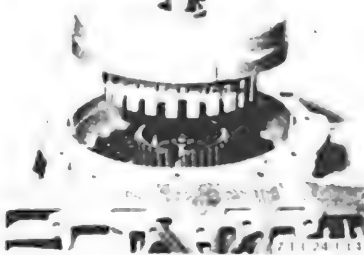
Place Special Tool 24 1 010 on output shaft and secure with collar nut.
Note:
 For version with spacer (5) a suitable pipe (6) must be used to take up the distance between case and special tool sleeve.

Unscrew Torx screws with Special Tool 00 2 100.

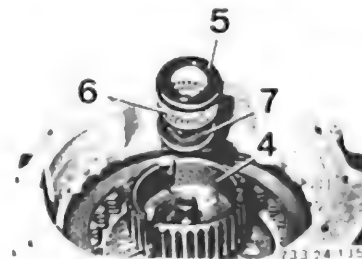
Set transmission upright.
 Unscrew converter bell housing and transfer plate.
Note:
 Only remove inner bolts of hole circle.



Remove angled washer (1), axial bearing (2) and thrust washer (3).

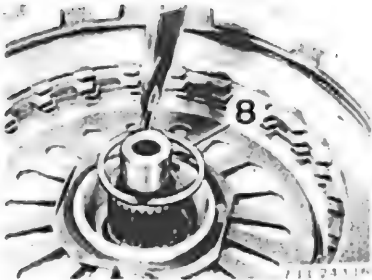


Remove input shaft with clutch A.



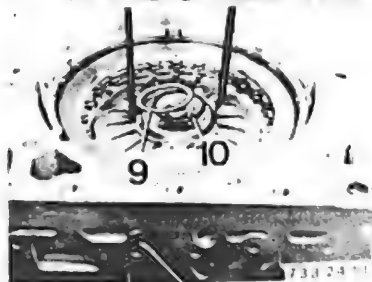
Remove plate carrier (4) for clutch A with angled washer (5), axial bearing (6) and thrust washer (7).

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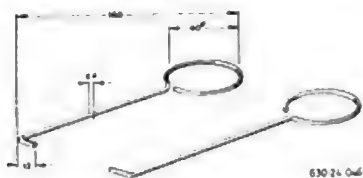
Remove snap ring (8) with help of two screwdrivers.

Installation:
Replace snap ring (8).

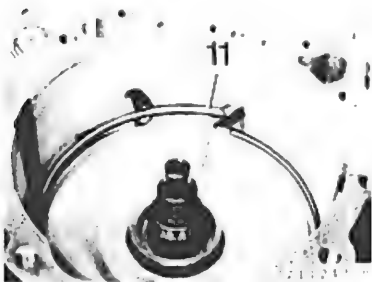


Pull out clutch B with two locally made hooks.

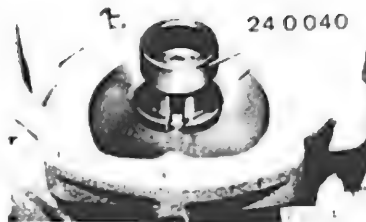
Installation:
Lift clutch until resistance is noticed and push back again.
Pull out clutch with one firm pull.
This will also pull out support (9) and seal (10).



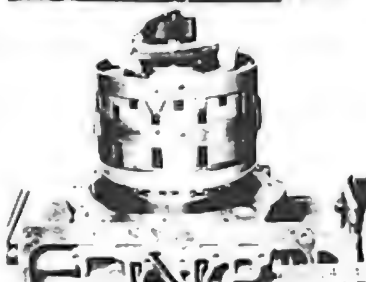
Sketch for local manufacture of hooks.
Dimensions in mm.



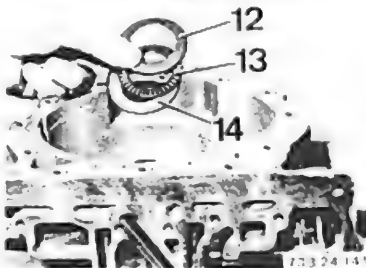
Lift out snap ring (11).



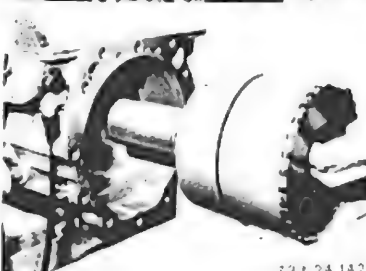
Apply Special Tool 24 0 040 on intermediate shaft.



Pull out entire set.



Remove angled washer (12), axial bearing (13) and thrust washer (14).



Position transmission case horizontally.
Remove 4th gear clutch set.

24-158

B) Assembling:
Install 4th gear clutch set.
Guide clutch set into transmission case that 4 oil feed bores are aligned with bores in case.

Insert snap ring (11).
Remove Special Tool 24 0 040.

Bolt down clutch set with Special Tools
00 2 100 and 00 2 050.
Tightening torque*.

Insert and press clutch B against stop.

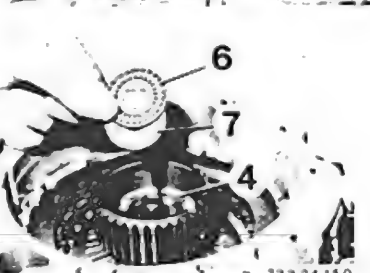
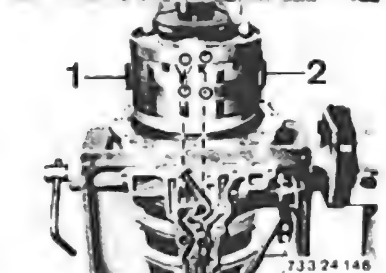
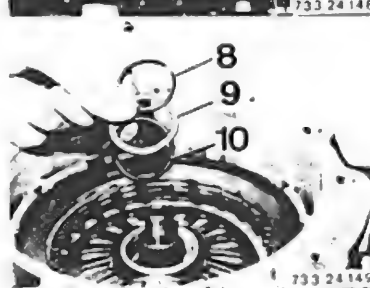
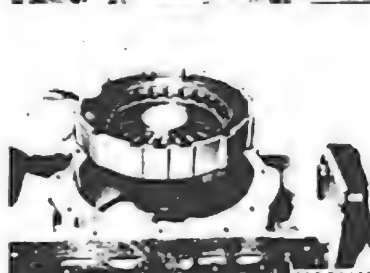
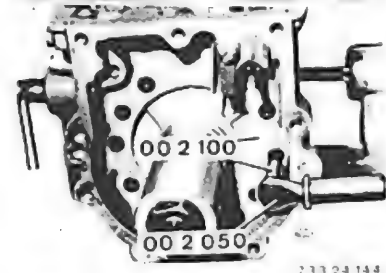
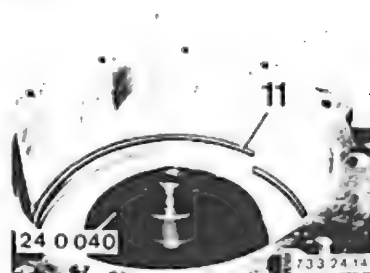
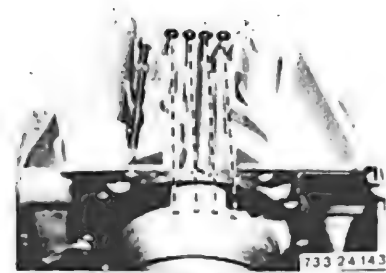
Set transmission upright.
Insert thrust washer (3), axial bearing (2) and
angled washer (1) with collar facing up.
If necessary, use vaseline on shaft of clutch set.

Install seal (10), support (9) and snap ring (8).

Place entire set in case.
Four oil feed bores must be aligned with bores
in case.
Springs (1 and 2) must be in center of cylinder
groove.

Insert plate carrier (4).
Install thrust washer (7) and axial bearing (6).

* See Specifications

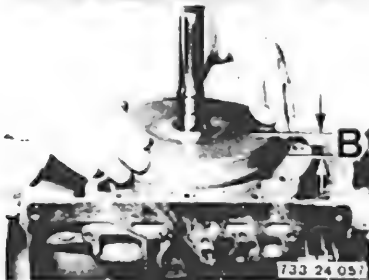


24-159

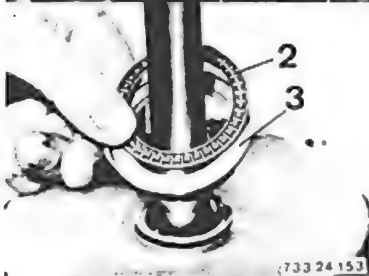
Paste angled washer (1) on cylinder A with grease (vaseline).



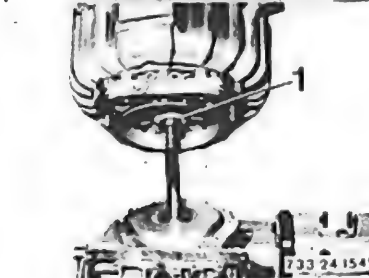
Insert clutch A and move it back and forth until splines of plate carrier and plates mesh.
Note:
Clutch A is in correct installed position, when distance (B) between cylinder A and case sealing surface is approx. 8 mm (0.315").
4 HP 24:
Distance (B) = approx. 25 mm (1").



Install angled washer (3) with collar facing up and axial bearing (2).



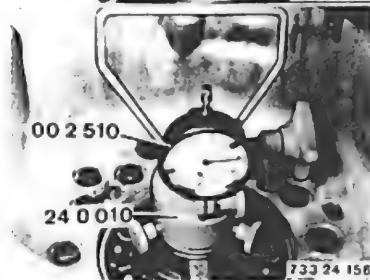
Paste on gasket and thrust washer (1) with grease (vaseline).



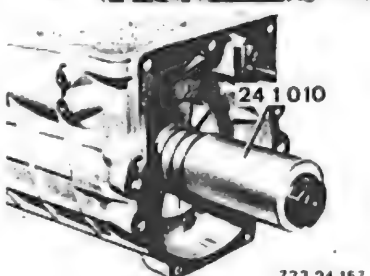
Install converter bell housing and tighten all bolts.
Tightening torque*.



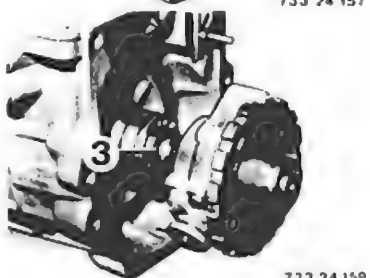
Check axial play of input shaft.
Mount Special Tool 24 0 010 to hold input shaft.
Apply Special Tool 00 2 510 (dial gage).
Check axial play by pulling input shaft.
Specification: 0.2 to 0.4 mm (0.008 to 0.016").
If play deviates, take off converter bell housing again and replace thrust washer with a thicker or thinner one.
Recheck axial play.
Bolt down converter bell housing.
Tightening torque*.



Remove Special Tool 24 1 010.

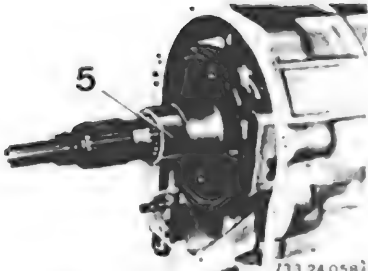


Lubricate O-ring (3) with ATF.
Slide on parking lock gear with regulator.
Note:
Install shim between the regulator and output flange for version without a spacer.

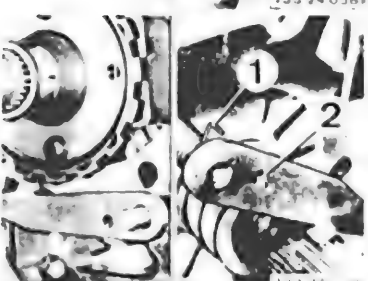


* See Specifications

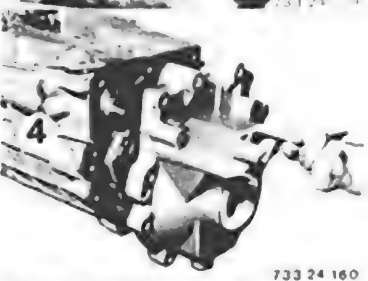
24-160



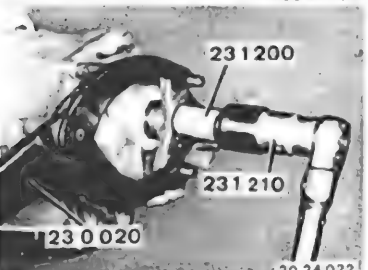
Important!
Version with Spacer (5):
Heat spacer (5) to about 80° C (175° F) with a hot air blower after mounting the parking lock gear and push spacer on to output shaft.



Install parking lock pawl.
Connect return spring (1) in bore (2) of parking lock pawl.



Paste on gasket (4) with grease.
Bolt on transmission extension.
Tightening torque*.

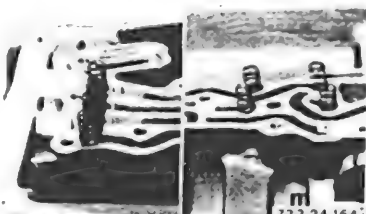


Install output flange.
Screw on collar nut with Hylomar SQ-32 M universal sealing compound.
Apply Special Tool 23 1 200 only for the version with a three-hole flange.
Hold output flange with Special Tool 23 0 020.
Tighten collar nut with Special Tool 23 1 210.
Tightening torque*.
Install lockplate.

* See Specifications



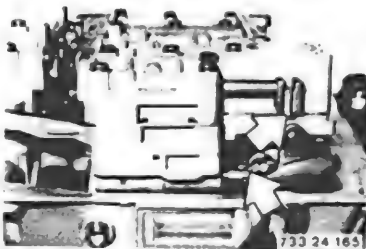
Install 8 sealing sleeves.
Press in sealing sleeves against the stop with a suitable mandrel.
Be careful not to damage the sealing sleeves.
EH Transmission:
Only 3 sealing sleeves have to be installed at cylinder F (output end).



Install 8 springs and 8 circlips.
Important!
Longer springs must be installed to face cylinder F (output end).
EH Transmission:
Only 3 springs have to be installed on cylinder F (output end).

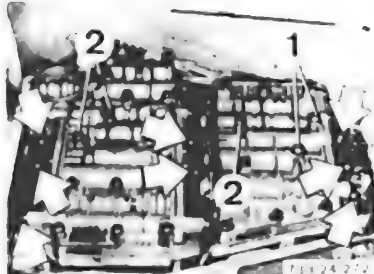


Note:
Version with Improved Lubrication on Cylinder F Gear Set:
Install sealing sleeve (4) in bore (1) with the tab facing the oil bore.
Press in sealing sleeve against the stop with a suitable mandrel.
Install spring and circlip.

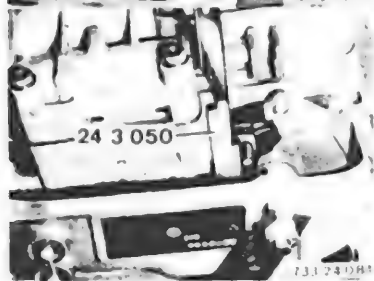


Mount valve body that selector valve can be connected in operating finger of pawl.
This requires pulling throttle cable slightly, so that accelerator cam does not clamp on throttle pressure valve.

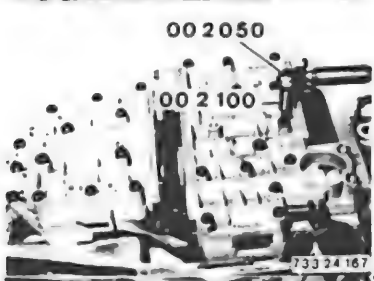
24-161



Screw in mounting bolts for valve body.
Important!
Bolts differ in length.
Bolts (1) – 65 mm long.
Bolts (2) – 60 mm long.



Align valve body with Special Tool 24 3 050.
Distance between valve body case and throttle pressure piston must be 11.5 mm (0.453").



Tighten valve body bolts with correct tightening torque*.
Tighten bolts with Special Tools 00 2 100 and 00 2 050.

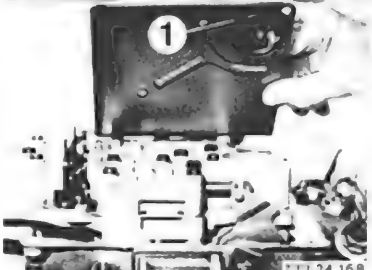


EH Transmission:
Check O-ring (4), replacing if necessary.
Insert socket with flat side facing out and bolt.
Tightening torque*.

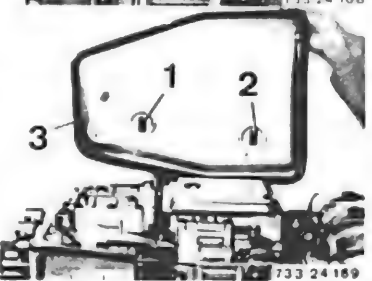
* See Specifications



Note:
Also mount pulse transmitter on control unit.
Engage tabs of holder (5) in grooves of plug.



Install O-ring (1) between valve body and oil filter screen.
Install and bolt down oil filter screen.
Tightening torque*.
Check length of bolts.
65 mm long.



Place magnets (1 and 2) in oil sump.
Install gasket (3).



Install oil sump and tighten bolts with brackets.
Tightening torque*.
Important!
Both brackets with straight, short legs must be mounted on straight side of oil sump.

* See Specifications

24-161a

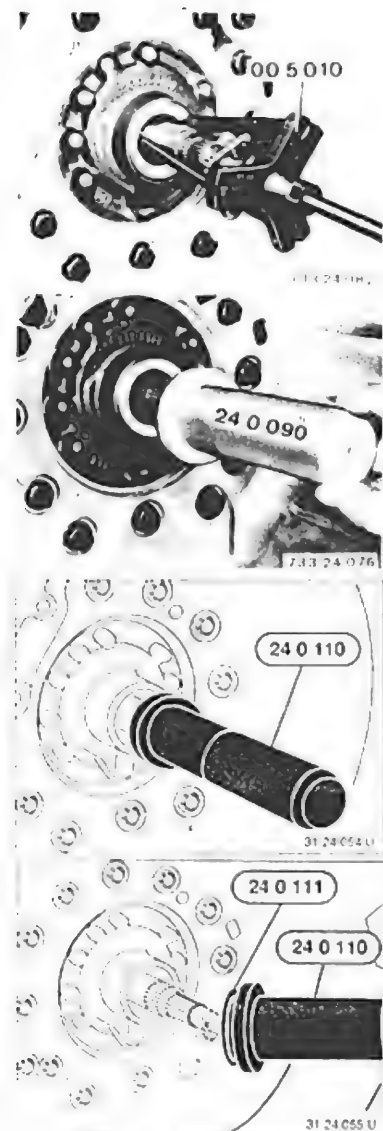
24 12 003 REPLACING RADIAL OIL SEAL FOR TORQUE CONVERTER

Remove torque converter – see 24 40 003.
Lift out radial oil seal.

Lubricate sealing lip with ATF.
Drive in radial oil seal to fit tight with
Special Tool 24 0 090.

4 HP-24 Transmission:
Drive in radial oil seal to fit tight with
Special Tool 24 0 110.
Special Tool 24 0 110 can also be used on
4 HP-22 transmissions.

Important!
Modified oil pump body since
Transmission No.
1 113 936 for 4 HP-22 or
0 029 160 for 4 HP-24.
Radial oil seal must be installed 1.0 mm
(0.039") deeper.
Drive in radial oil seal to fit tight with
Special Tools 24 0 110 and 24 0 111.



24-161b

24 16 502 REPLACING TRANSFER PLATE — Transmission Removed —

Remove torque converter 24 40 003.
Mount transmission on Special Tool 24 0 150
in conjunction with an assembly stand.
Important!
Only screw in bolts finger tight to avoid case
distortion.

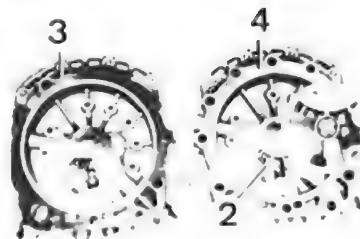
Unscrew converter bell housing and transfer
plate, removing the inner bolts only and
loosening the outer bolts for this purpose.

Lift off converter bell housing.

Installation:
Thrust washer (1), needle cage and angled
washer.

Note:
Axial play of input shaft can be adjusted with
thrust washer (1).
Replace gasket (2).

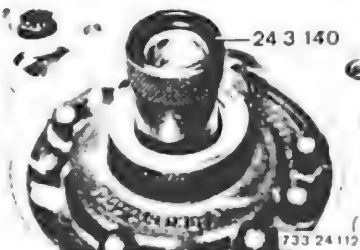
Remove primary pump (see 24 31 002).
Unscrew bolts.
Lift converter bell housing off of transfer plate.



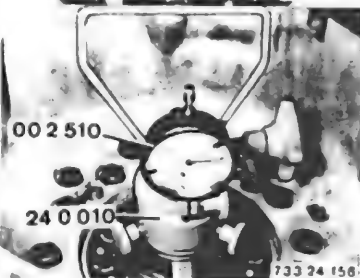
733 24 274



733 24 275



733 24 112



733 24 156

A transfer plate with venting valve (2) is used
since Transmission No. 170 195.
The venting valve provides faster clutch A
pressure dropping.
Only use transfer plates with a venting valve
for repairs.
Transfer plate (3) without venting valve.
Transfer plate (4) with venting valve.

Transfer plugs (5 ... 8).
Check seals, replacing if necessary.
Tightening torque*.

Mount transfer plate on converter bell housing
with the outer bolts which must be screwed in
finger tight.
Align bores for inner bolts.
Install primary pump and check running with
Special Tool 24 3 140.

Mount converter bell housing and tighten all
bolts to correct torque*.
Check axial play of input shaft.
Hold input shaft with Special Tool 24 0 010.
Apply Special Tool 00 2 510 (dial gage).
Check axial play by pulling input shaft.
Specification: 0.2 to 0.4 mm (0.008 to 0.016").
If play deviates, remove converter bell housing
again and install a thicker or thinner thrust
washer.
Recheck axial play.
Tighten converter bell housing bolts.
Tightening torque*.
* See Specifications

24 0 150

733 24 273

733 24 277

733 24 276

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24 23 022 REPLACING PLATE TYPE CLUTCHES AND BRAKES

Disassemble transmission — see 24 00 080.
Important!

When repairing clutch A, check the transfer plate for an installed ventilating valve — see 24 16 502.

If necessary, install a transfer plate with a ventilating valve.

Clutch A:

Press out input shaft (1).

Check O-ring (2), replacing if necessary.

Compress clutch set and remove snap ring (3).

Remove plate carrier (4).

Lift out plate set and diaphragm spring.

4 HP 24:

Without diaphragm spring.

Important!

Note quantity of steel and lined plates.

4 HP 24:

Bend open lockplate (1).

Press down on diaphragm spring with Special Tool 24 2 040.

Lift out snap ring (2).

Installation:

Replace and lock lockplate.

Install diaphragm spring with curved surface facing up.

Press out clutch A piston with compressed air applied through oil bore.

Installation:

Replace O-rings (5 and 6).

Lubricate O-rings with a light coat of ATF to make installation easier.

Installed Order of Plates:

Insert noted quantity of removed steel and lined plates alternately, beginning with spring and steel plates.

- 1 Spring plates
- 2 Steel plates 1.8 mm (2.1 mm for 750 i)
- 3 Lined plates
- 4 Plate carrier

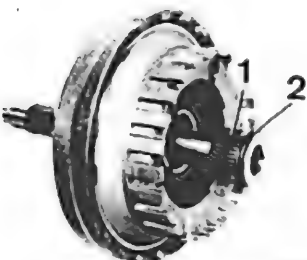
BMW 745 i:

Watch installed order of plates.

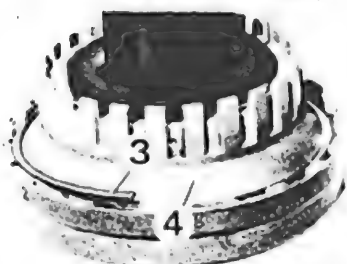
- 1 Spring plates
- 2 Steel plates 1.8 mm
- 2a Adjusting plate 1.8 or 1.2 mm
- 3 Lined plates

Important!

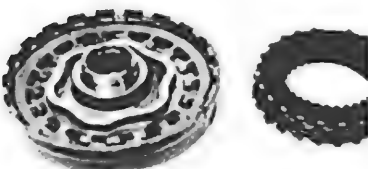
Only use complete installation kit for repairs.



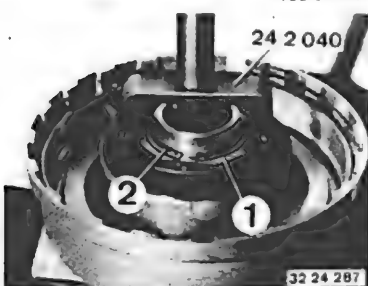
733 24 171



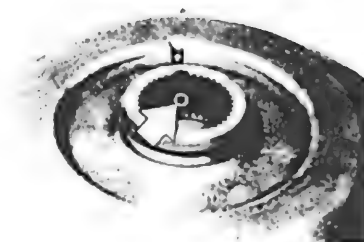
733 24 177



733 24 173



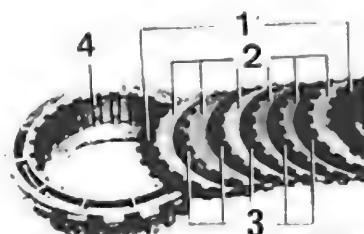
32 24 287



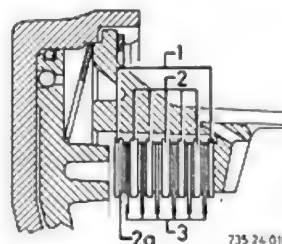
733 24 174



733 24 175



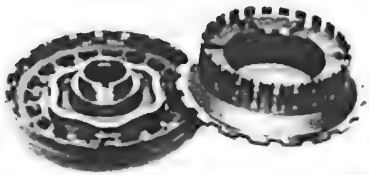
733 24 176



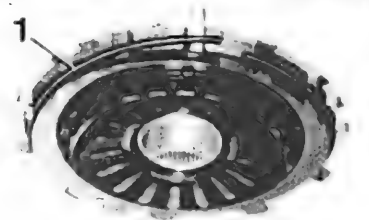
735 24 018

24-163

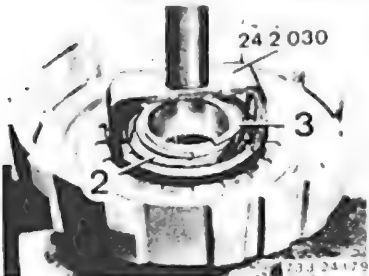
Place diaphragm spring in input shaft case with curved surface facing down.
Insert plate set with plate carrier.
Compress clutch set and insert snap ring.



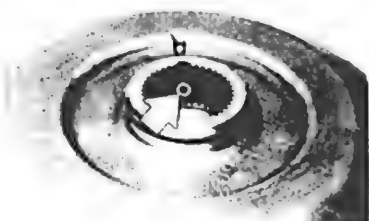
733 24 177



733 24 178



733 24 179

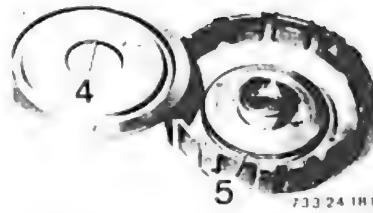


733 24 180

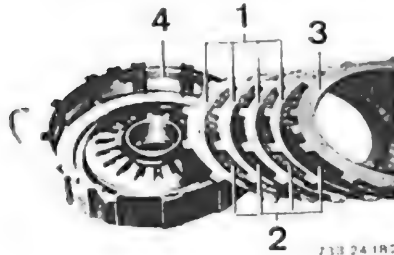
Clutch B:
Remove snap ring (1).
Remove steel and lined plates.
Important!
Note quantity of steel and lined plates.

Bend open lockplate (2).
Press down on diaphragm spring with Special Tool 24 2 030 and remove snap ring (3).
Installation:
Replace and lock lockplate.
Install diaphragm spring with curved surface facing up.

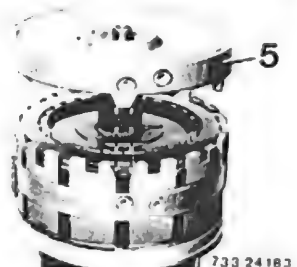
Press out clutch B piston with compressed air applied through oil bore.



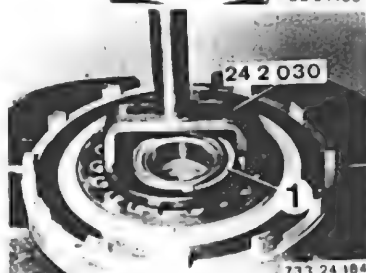
733 24 181



733 24 182



733 24 183



733 24 184

Installation:
Check O-rings (4 and 5), replacing if necessary.
Lubricate O-rings with a light coat of ATF to make installation easier.

Installed Order of Plates:
Insert noted quantity of removed steel and lined plates alternately, beginning with a steel plate.
1 Steel plates (1.8 mm)
(2.1 mm for BMW 635 CSi, 735i, 745i, 750i)
2 Lined plates
3 End plate (4.5 mm)
(3.0 mm for BMW 750 i)
4 Housing
Important!
Insert end plate with ground surface facing lined plate.

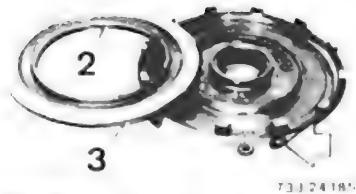
Clutch C' and C:
To make this step easier, place complete set in a suitable pipe and clamp in a vise.
Remove Special Tool 24 0 040.
Lift off centering plate (5).
Installation:
Bevelled beads must engage in bevelled openings.

Press down on diaphragm spring with Special Tool 24 2 030 and lift out split retaining ring (1).
Installation:
Insert diaphragm spring with curved surface facing up.

24-164

Press out piston for clutch C' with air pressure applied through the oil bore.

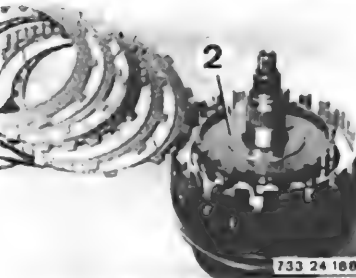
Installation:
Check O-rings (2 and 3), replacing if necessary.
Coat O-rings lightly with ATF to make installation easier.



733 24 187

Remove all steel and lined plates.

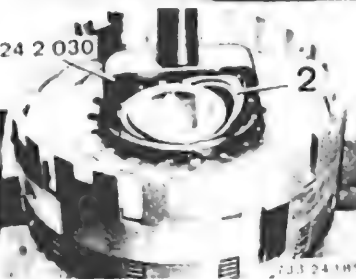
Note:
Note number of steel and lined plates.
Pull out one-way clutch (2).



733 24 188

Press down disc spring with Special Tool 24 2 030 and lift out split retaining ring (2).

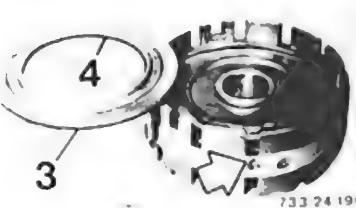
Installation:
Install disc spring with curved surface facing up.



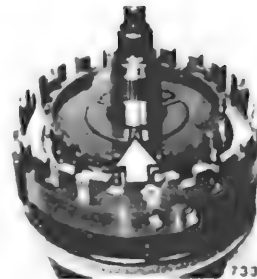
733 24 189

Press out piston for clutch C with air pressure applied through the oil bore.

Installation:
Check O-rings (3 and 4), replacing if necessary.
Coat O-rings lightly with ATF to make installation easier.



733 24 190

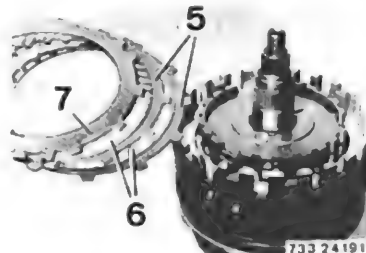


733 24 166

Install one-way clutch.

Important!
Bent tabs or the word "oben" (= top) must be visible.

4 HP-24:
Rivet heads must be on top.



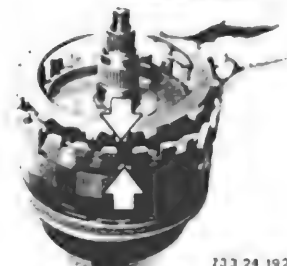
733 24 191

Installed Order:
Install noted number of removed steel and lined plates alternately, beginning with a steel plate.
5 Steel plates (1.8 mm)

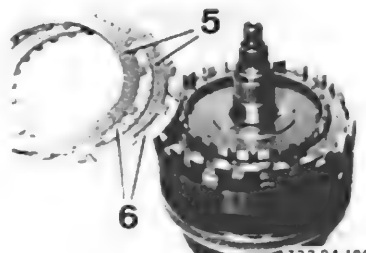
Important!
Thickness of steel plates is different for 635 CSI and 735 l cars (1.5 mm and 2.1 mm).
4 HP-24: 1.8 mm and 2.1 mm.
2.1 mm for all plates since Transm. No. 21 250.
Thinner steel plate (1.5 mm) must be mounted on the piston end.

6 Lined plates
7 End plate (4.5 mm)

Important!
Install end plate that the middle tooth of a group of three teeth bears in the opening of the cylinder.



733 24 192

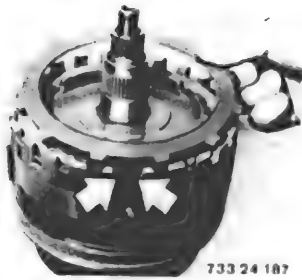


733 24 186

Installed Order for C':
Install noted number of removed steel and lined plates alternately, beginning with a steel plate.
5 Steel plates (1.8 mm)
6 Lined plates

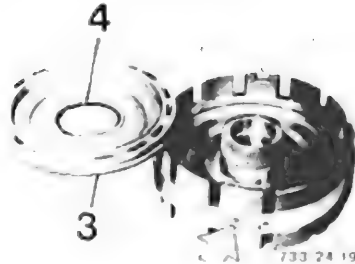
Important!
Thickness of steel plates is different for 635 l and 735 l cars (1.5 mm and 2.1 mm). Thinner steel plate (1.5 mm) must be mounted on the piston end.
4 HP-24: 1.8 mm and 2.1 mm.

24-165



733 24 187

6 Lined plates
Important!
External splines of steel plates must not be placed in bevelled openings of cylinder.



733 24 196

Press out clutch D piston with compressed air applied through oil bore.

Installation:
Check O-rings (3 and 4), replacing if necessary. Lubricate O-rings with a light coat of ATF to make installation easier.

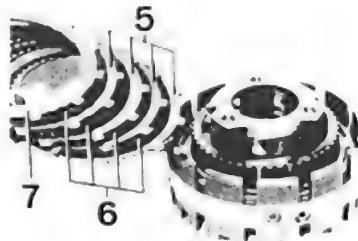
Clutch D:
Clutches C' and C removed.
Lift clutch member with clutch D off of planet gear set.

Place planet plate with one-way clutch on hub of cylinder D.



733 24 194

Remove snap ring (1).
Remove outer and lined plates.
Important!
Note quantity of steel and lined plates.



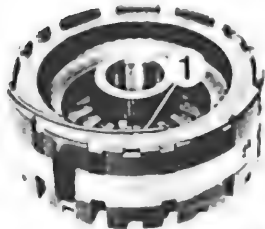
733 24 198

Installed Order of Plates:
Insert noted quantity of removed steel and lined plates alternately, beginning with a steel plate.

5 Steel plates (1.8 mm)
1.2 mm for BMW 745 i, 750 i

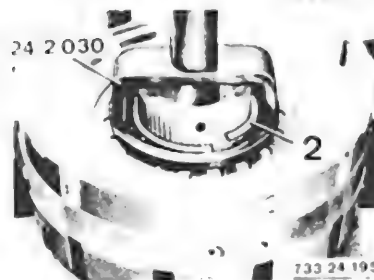
6 Lined plates
7 End plate (1.2 mm)

Insert clutch body with clutch D in planet gear set.



733 24 194

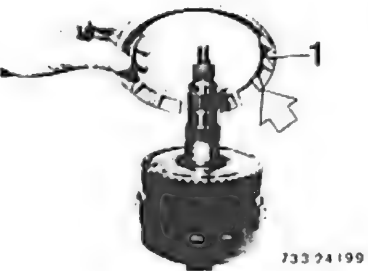
Press down on diaphragm spring with Special Tool 24 2 030 and lift out snap ring (2).
Installation:
Insert diaphragm spring with curved surface facing up.



733 24 195

24-166

Disassemble planet gear set.
Remove support ring (1).
Installation:
Mount support ring with fins facing down.



Take off planet gear set (2).



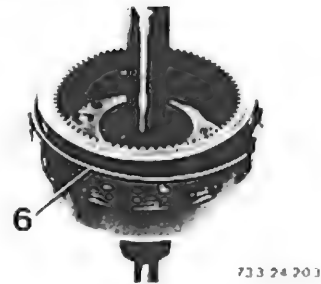
Pull out sun gear shaft (3).



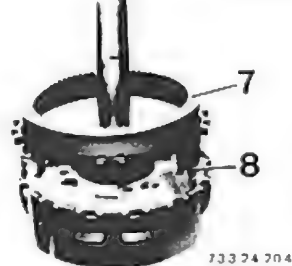
Remove axial bearing (4) and thrust washer (5).



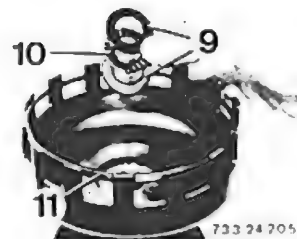
Lift out snap ring (6).



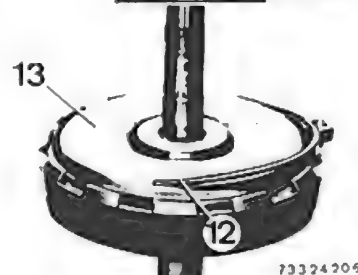
Remove hollow gear (7) and planet plate (8).



Remove thrust washers (9) and axial bearing (10).
Take off spacer (11).

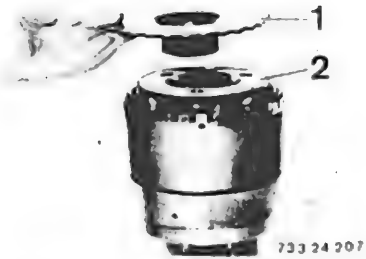


Lift out snap ring (12).
Take off hollow gear (13).



24-167

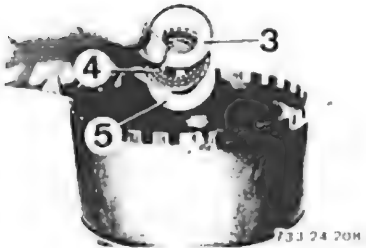
Clutches E and F:
Remove sun gear (1) and planet carrier (2).



733 24 207

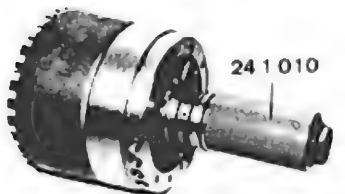
Remove angled washer (3), axial bearing (4) and thrust washer (5).

Installation:
Install angled washer (3) with collar facing planet carrier.



733 24 208

Take off Special Tool 24 1 010.



24 1 010

733 24 209

Lift cylinder F off of cylinder E.



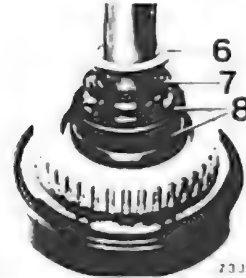
733 24 210

Lift off cylinder E on output shell.



733 24 211

Take off thrust washer (6), axial bearing (7) and steel/copper angled washer (8).



733 24 212

Installation
Mount cylinder E and turn until it rests on stop. Cylinder must rest on copper angled washer. When holding output shaft it must now be possible to turn cylinder E clockwise. It should lock in opposite direction.



733 24 213

Clutch F:
Lift out snap ring (1).



733 24 214

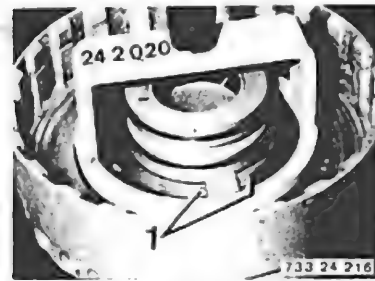
24-168

Remove plate set.
Important!
Note quantity of steel and lined plates.



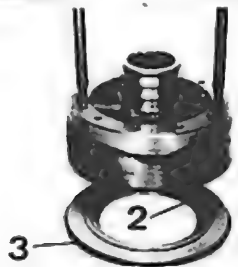
733 24 215

Remove piston for clutch F.
Press down on diaphragm spring with Special Tool 24 2 020 and lift out the split retaining ring (1).
Installation:
Insert diaphragm spring with curved surface facing up.



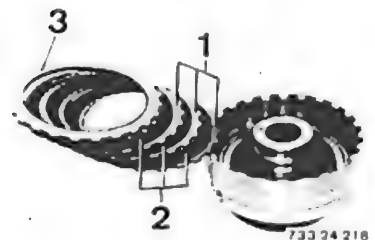
733 24 216

Press out piston for clutch F with two suitable mandrels.
Installation:
Check O-rings (2 and 3), replacing if necessary.
Lubricate O-rings with a light coat of ATF to make installation easier.



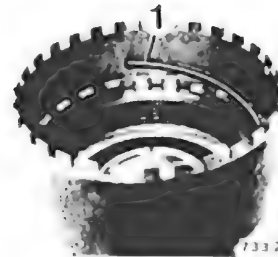
733 24 217

Installed Order of Plates:
Insert noted quantity of removed steel and lined plates alternately, beginning with a steel plate.
1 Steel plates (2.1 mm)
2 Lined plates
3 End plate (4.5 mm)



733 24 218

Clutch E:
Lift out snap ring (1).



733 24 219

Remove plate set.
Important!
Note quantity of steel and lined plates.



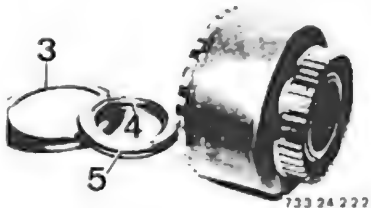
733 24 220

Remove piston for clutch E.
Press down on diaphragm spring with Special Tool 24 2 020 and remove the split retaining ring (2).
Installation:
Insert diaphragm spring with curved surface facing up.



733 24 221

Lift off thrust plate (3).
Press out clutch E piston with compressed air applied through oil bore.
Installation:
Check O-rings (4 and 5), replacing if necessary.
Lubricate O-rings with a light coat of ATF to make installation easier.

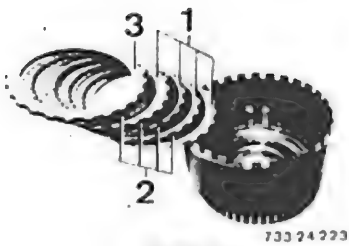


733 24 222

24-169

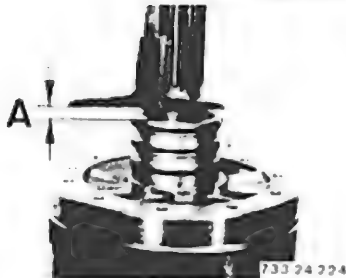
Installed Order of Plates:
 Insert noted quantity of removed steel and lined plates alternately, beginning with a steel plate.

- 1 Steel plates (1.5 mm)
- 2 Lined plates
- 3 End plate (4.5 mm)



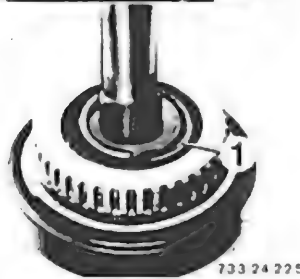
733 24 223

Connect cylinders E and F by turning.
 Collar on output shaft will protrude by distance A = approx. 10 mm (0.394") when installed correctly.
 Apply Special Tool 24 1 010.
 Install planet gear carrier and sun gear.



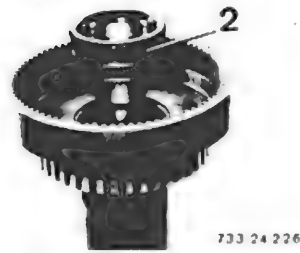
733 24 224

Removing One-way Clutch:
 Lift out snap ring (1).

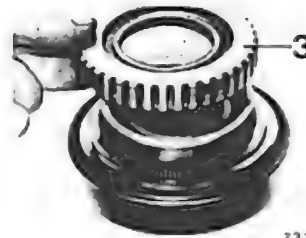


733 24 225

Press out output shaft (2).



733 24 226



733 24 227

Lift off plate carrier (3).



733 24 228

4 HP - 22:
 Lift out snap ring (1).
 Lift off one-way clutch.



733 24 228

Pull or press off one-way clutch.



733 24 229

Press one-way clutch cage out of outer race carefully.
Caution!
 Needles could pop out of cage.

24-170

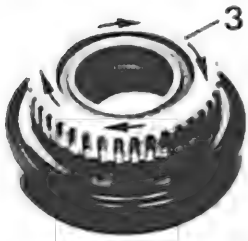
Installation:

Place one-way clutch cage on outer race and align.

Press in one-way clutch cage against stop and then turn until metal edge engages in holding groove of outer race.



733 24 230



733 24 231

Use plate carrier (3) to turn one-way clutch outer race clockwise and mount race on inner race.



733 24 232

Clearance between one way clutch inner race and outer race should be at least 0.1 mm (0.004").

24-172

24 31 002 REMOVING AND INSTALLING PRIMARY PUMP

Remove torque converter — see 24 40 003.
Take off converter bell housing with connecting plate.

Installation:

Mount angled washer (1) with collar facing needle bearing (2) on input shaft.
Hold thrust washer (3) on converter bell housing with grease.
Replace gasket (4).

Unscrew primary pump on converter bell housing.
Loosen two bolts opposite each other by only several turns.
Loosen primary pump on converter bell housing with several light knocks.

Remove primary pump.

Installation:

Centering pin (5) must engage in bore (6).

Installation:

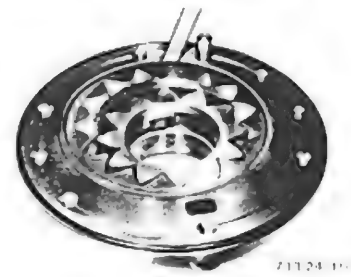
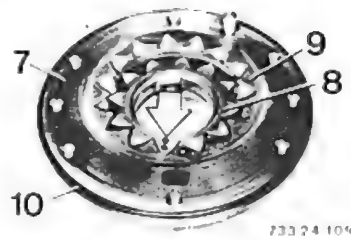
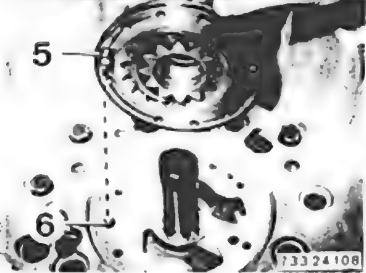
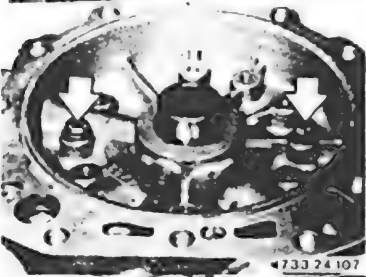
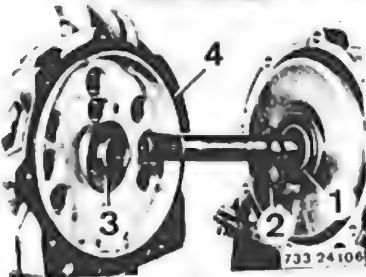
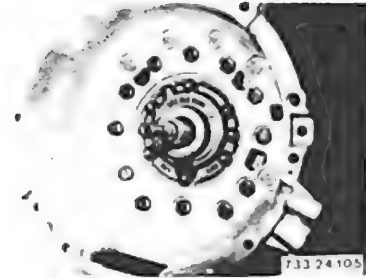
Primary pump, consisting of pump body (7), hollow gear (8) and impeller (9), may only be replaced as an assembly.
Check O-ring (10), replacing if necessary.
Important!
Install hollow gear (8) and impeller (9) that punch marks face up.

Check radial play* between driven gear and pump body, while turning gear 360°.

Check axial play* of both gears to face surface with a precision depth micrometer.

Check running of primary pump with Special Tool 24 3 140.

* See Specifications



24-173

24 40 003 REMOVING AND INSTALLING TORQUE CONVERTER

Remove transmission — see 24 00 022 in pertinent model repair manual microfiche beginning with 1985 models.

Pull torque converter out of primary pump carefully with Special Tool 24 4 000.

Caution!
Escaping ATF.

Installation:

Check torque converter for leaks with Special Tools 24 4 041, 24 4 043 and 24 4 062 or 24 4 044 for 4 HP 24.

Test pressure: 0.5 bar (7 psi).

Important!

Always use Special Tool 24 4 043 to prevent injury.

A torque converter must be replaced when bearing surface on converter shaft is damaged.

Turn slightly to guide openings on converter into primary pump carefully, using Special Tool 24 4 000.

Important!

Be careful not to damage converter bearings and seal while guiding in. Converter is in its correct installed position, if drive ring is below case edge.

Checking Installed Torque Converter:

Engine and transmission oil must have operating temperature.

Engine must produce full rated power.

Start engine.

Pull on parking brake and operate brake pedal firmly.

Move selector lever to D and press accelerator pedal to full throttle.

Read stall speed* from tachometer.

Important!

Never test stall speed longer than 10 seconds to prevent damage from excessive heat.

Stall Speed Much Above Specified Value*:

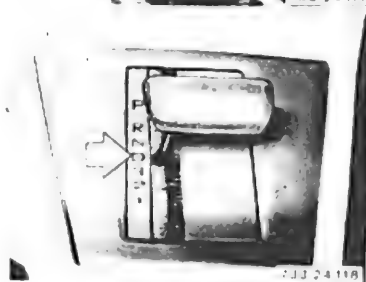
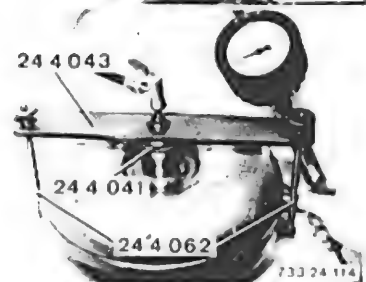
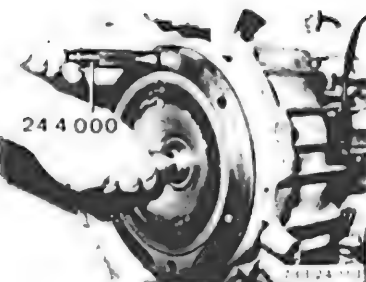
- Converter oil volume insufficient — correct oil level.
- Slip in clutches — check clutches.

Stall Speed Much Below Specified Value*:

- Engine power insufficient — check engine.
- Converter or pump defective — replace converter or check pump.

Torque converters cannot be cleaned with conventional workshop equipment and must be replaced when a transmission had been defective or an oil filter screen torn. Converter identification*.

* See Specifications



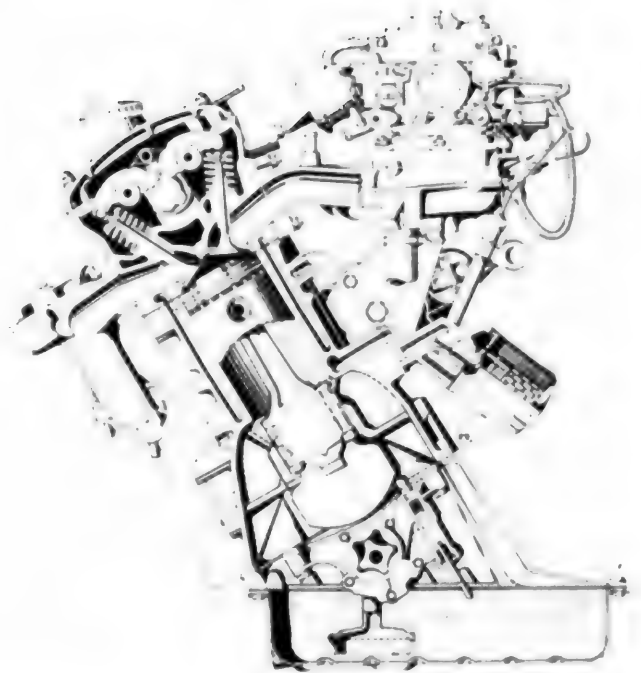
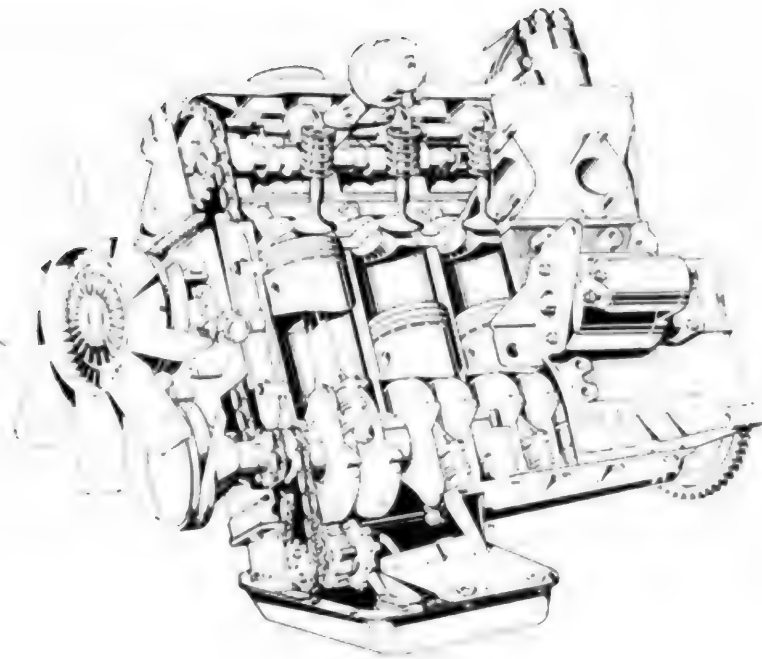
11 Engine M10

11 12 000	Cylinder head cover – remove and install	11-	1
101	Cylinder head gasket – replace	11-	1
500	Cylinder head – remove and install (engine removed)	11-	2
591	Valve guide – replace (valves removed)	11-	3
595	Valve guide – inspect for wear	11-	3
600	Valve guide – ream	11-	3
607	Valve seats and valves – machine (cylinder head disassembled)	11-	3
719	Cylinder head sealing surface – grind (cylinder head disassembled)	11-	4
729	Cylinder head – check for cracks in water test (cylinder head disassembled)	11-	4
11 14 100	Timing case cover, upper – remove and install/seal	11-	5
120	Timing case cover, lower – remove and install/seal	11-	5
141	Radial oil seal in timing case cover – replace	11-	7
605	Radial oil seal in clutch end cover – replace (transmission removed)	11-	7
11 21 000	Crankshaft – remove and install	11-	8
120	Pulley on crankshaft – remove and install	11-	9
501	Crankshaft – replace (crankshaft removed)	11-	10
531	Crankshaft main bearing shells – replace (engine disassembled)	11-	10
571	Pilot bearing in crankshaft – replace	11-	11
11 22 000	Flywheel – remove and install	11-	12
051	Drive plate for torque converter – replace	11-	12
541	Starter gear ring – replace	11-	12
11 24 521	Connecting rods – replace (pistons removed)	11-	13
571	Conrod bearing shells – replace (disassemble engine)	11-	13
11 25 000	Piston – remove and install	11-	14
651	Piston rings of one piston – replace (piston removed)	11-	15
11 31 000	Camshaft – remove and install	11-	16
051	Timing chain – replace	11-	17
061	Timing chain sprocket set – replace	11-	18
090	Timing chain tensioner piston – remove and install	11-	19
601	Tensioning rail / guide rail – replace (timing chain removed)	11-	19
11 33 020	Rocker arm shafts – remove and install	11-	20
031	Rocker arms – replace	11-	21
11 34 004	Valve clearance – adjust	11-	21
509	Valves – check for leaks (camshaft removed)	11-	21
550	Valves – remove and install (rocker arm shafts removed)	11-	22
	Engine oil circuit	11-	23
11 40 000	Engine oil pressure – check	11-	24
11 41 000	Oil pump – remove and install	11-	24
151	Oil pump drive chain – replace	11-	25
11 42 020	Full flow oil filter – remove and install/seal	11-	26
021	Full flow oil filter – replace	11-	26
11 51 000	Water pump – remove and install	11-	26
502	Water pump – overhaul	11-	27
11 52 000	Fan – remove and install	11-	28
020	Fan coupling – replace	11-	28
11 53 000	Coolant thermostat – remove and install	11-	28

11-0

M 10
B
18
V
L
A.C/S/U

- 4 cylinders
- Gasoline
- Displacement (x 100)
- Carburetor
- L Jetronic
- A.C/S/U : Australia/Switzerland/Sweden/USA



M 10 B 18 V - BMW 316 518
M 10 B 18 L - BMW 318 i/518
M 10 B 18 L U - BMW 318 i (Catalytic Converter)
M 10 B 18 L A C/S - BMW 518 i (Emission Control)

11-1



11 12 000 REMOVING AND INSTALLING CYLINDER HEAD COVER

Disconnect hose (8)
 Unscrew cylinder head cover
Installation:
 Tighten nuts and bolts in order of 1 - 7
 Tightening torque*
 Also screw on holder for ignition lead
 Check gasket, replacing if necessary

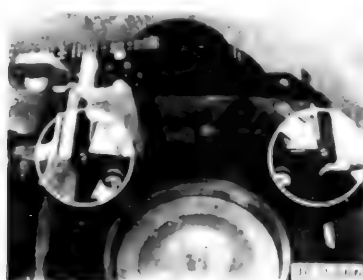


11 12 101 REPLACING CYLINDER HEAD GASKET

Remove cylinder head 11 12 100
 Clean sealing surfaces on cylinder head and crankcase - use gasket remover** and a hard wood scraper
 Check levelness with a standard steel ruler, grinding cylinder head sealing surface (see 11 12 719) if necessary

Installation:
 Only use original cylinder head gaskets to guarantee precise matching of holes and openings for coolant

A gasket with standard thickness may be installed on a reground cylinder head, or a gasket which is 0.3 mm (0.012") thicker in order to avoid reduction in combustion chamber size
 Identification
 Stamped codes
 18 / 18 E / 20 / 20 E



Important!
 Fill bores with a brush on type universal sealing compound / Three Bond Silicone 1207** prior to installation of timing case cover

* See Specifications

** Source: HWB

11-2

11 12 500 REMOVING AND INSTALLING CYLINDER HEAD Engine Removed

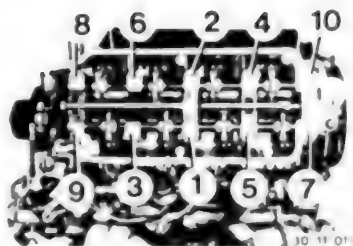
Disconnect hose (8)
Remove cylinder head cover
Installation:
Tighten nuts and bolts in order of 1 - 7
Also screw on holder for ignition lead
Tightening torque*
Check gasket, replacing if necessary

Remove upper timing case cover - see 11 14 100
Remove distributor - see 12 11 060
Turn crankshaft until cylinder no. 1 is at TDC - cast boss aligned with notch in pulley

Remove piston for chain tensioner - see 11 31 090
Unscrew sprocket
Caution!
Never turn engine after removing the timing chain
Installation:
Position timing chain that the bore for the dowel pin faces down
Tightening torque*

Installation:
Turn in the camshaft before mounting the cylinder head, so that notch in camshaft flange is aligned with cast boss on cylinder head
Cylinder no. 1 is at TDC
Also install the timing chain in this position

* See Specifications



Unscrew cylinder head bolts in order of 10 - 1 and lift off the cylinder head

Installation:
Keep oil out of cavities since otherwise bolts tightened with the specified torque might not exert sufficient pressure on the cylinder head. In addition, the crankcase might be cracked.
Clean cylinder head bolts
Lubricate threads and bearing surfaces of bolt heads with a light coat of oil
Replace cylinder head gasket - see 11 12 101

Tighten bolts in order of 1 - 10 in 3 steps*
Adjust valve clearance - see 11 34 004
Adjust ignition timing - see 12 11 004
Adjust engine idle speed and CO level - see 13 00 054
Tighten cylinder head bolts to specified torque angle with Special Tool 11 2 110 regardless of the engine temperature in the 3rd step (cover of cylinder head removed again after running engine warm).

Note:

Cylinder head is not tightened again after 1 000 km (600 miles).

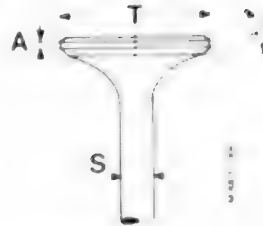
* See Specifications

11-3



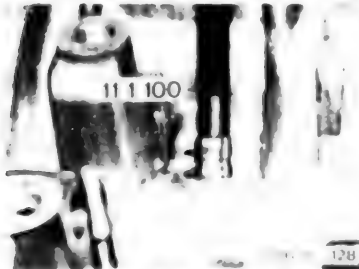
11 12 595 CHECKING VALVE GUIDE FOR WEAR - Valve Removed

To measure wear, insert a new valve that the end of the valve stem is flush with the valve guide.
Set up dial gage and measure tilt clearance.
Max. permissible tilt clearance*



11 12 607 MACHINING VALVE SEATS AND VALVES Valves Removed

Valve must be replaced, if edge thickness A* is less than specified

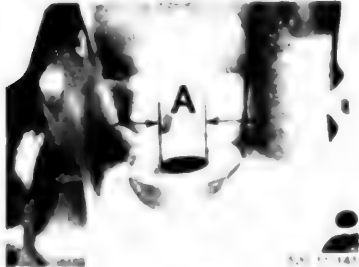


11 12 591 REPLACING VALVE GUIDE Valves Removed

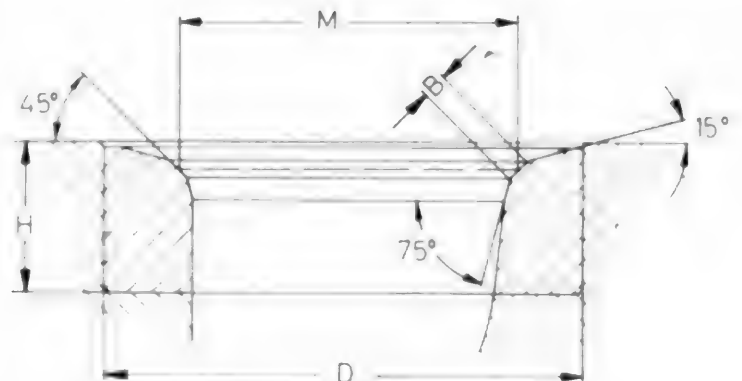
Drive out valve guide cold into the combustion chamber with Special Tool 11 1 100



Machine correction angles* to produce valve seat diameter M* and valve seat width B* after machining the valve seat angle*.
Grind in valves with grinding paste and check valves for leaks - see 11 34 509



Check bore (A) in cylinder head.
If permissible diameter* is exceeded, bore must be reamed out and an oversize* valve guide installed.



Heat* cylinder head.
Drive in valve guide (3) from the camshaft end with Special Tool 11 1 160.
Bore in the special tool determines the amount of protrusion*.
Ream out valve guide to specified inside diameter.
Machine valve seats - see 11 12 607

* See Specifications

* See Specifications

11-4

11 14 100 REMOVING AND INSTALLING SEALING UPPER TIMING CASE COVER

Remove cylinder head cover 11 12 000

Unscrew bracket (1)

Unscrew timing case.

Installation:

Tighten bolts (2 and 3) finger tight.

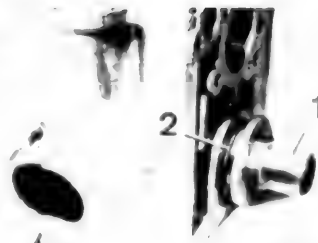
Then tighten bolts (4 - 9) one after the other and finally bolts (2 and 3)

Replace gasket and hold new gasket in position with grease

Important!

Coat bores with a brush on type universal sealing compound - Three Bond Silicon 1207** before installing the timing case cover

If damaged, replace cylinder head gasket



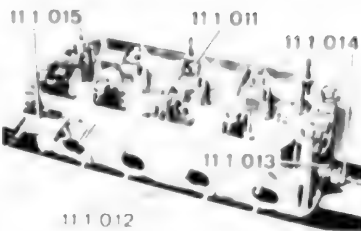
11 14 120 REMOVING AND INSTALLING SEALING LOWER TIMING CASE COVER

Disconnect battery ground lead

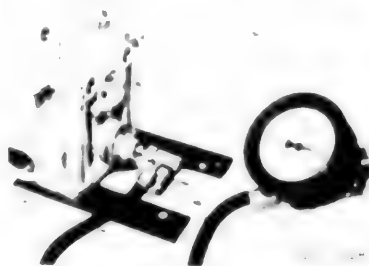
Remove upper timing case cover 11 14 100

Disconnect wires on alternator

Unscrew bolt on crankcase



Unscrew alternator with console and tensioning bar



All Cars with Power Steering

Loosen drive belt

Unscrew bracket (1)

Pressure hoses remain connected

Installation:

Tighten drive belt and check tightness with Special Tool 11 5 020

Remove water pump 11 51 000

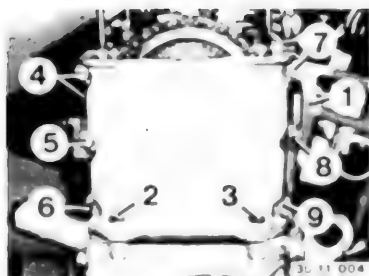
Remove crankshaft pulley 11 21 120

Remove chain tensioner piston 11 31 090

Unscrew remaining timing case cover bolts

** Source HWB

11-5



Two Piece Oil Pan:
Unscrew reinforcement plate
Remove oil pan lower section 11 13 020



Unscrew bolts (1 - 3)
Loosen remaining oil pan bolts

Lift oil pan gasket off of timing case cover
carefully with a knife
If oil pan gasket is damaged, remove oil pan
11 13 000

Take off timing case cover

Installation:

Coat mating surfaces between oil pan and
crankcase with a brush-on type universal
sealing compound / Three Bond Silicon
1207**

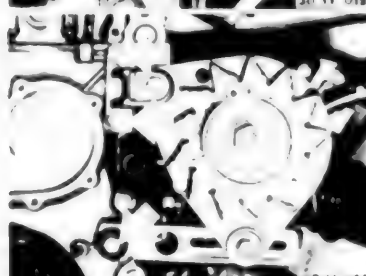
Important!

Take up web for tensioning piston must
extend into oil pocket

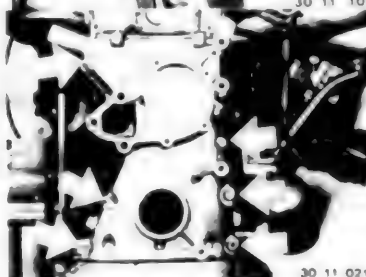
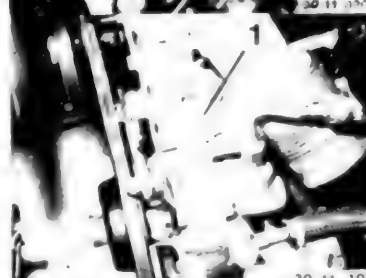
** Source: HWB



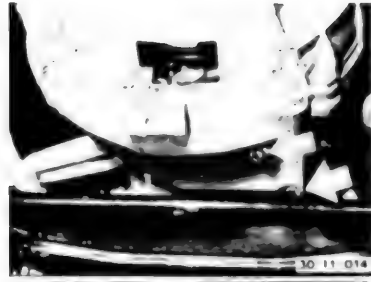
One Piece Oil Pan
Unscrew reinforcement plate



Unscrew oil pan bolts at front end
Loosen all other oil pan bolts



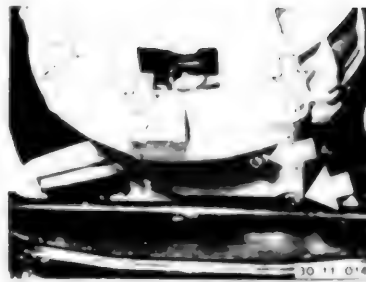
11-6



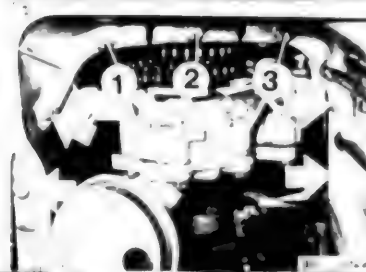
One Piece Oil Pan
Unscrew reinforcement plate



Unscrew front oil pan bolts
Loosen all other oil pan bolts



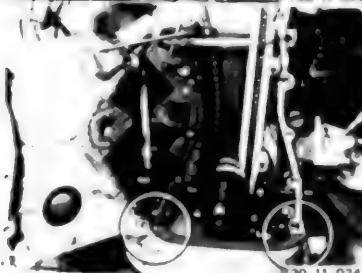
Two Piece Oil Pan:
Unscrew reinforcement plate
Unscrew lower oil pan section - 11 13 020



Unscrew bolts (1 ... 3)
Loosen all other oil pan bolts
Installation:
Install bolts (1 ... 3) with Loctite No. 270**



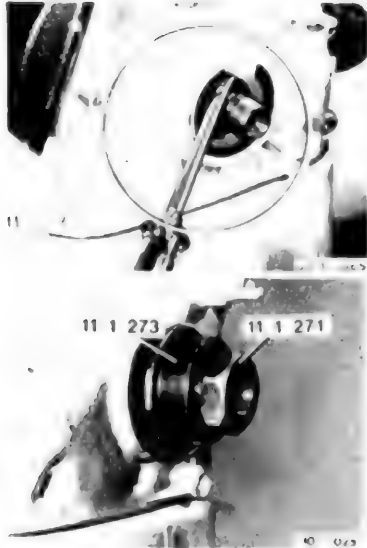
All Models.
Pry oil pan gasket off of timing case cover
carefully with a knife
Remove oil pan - see 11 13 000 - if oil pan
gasket is damaged



Remove timing case cover
Installation:
Coat mating surfaces between oil pan and
crankcase with a brush on universal sealing
compound (Three Bond Silicone 1207**)
Important!
Take up for tensioning piston must be located
in the oil pocket

** Source: HWB

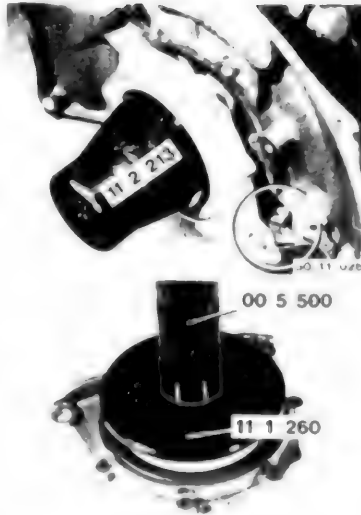
11-7



11 14 141 REPLACING RADIAL OIL SEAL IN TIMING CASE COVER

Remove crankshaft pulley - 11 21 120
Lift out radial oil seal with a screwdriver

Lubricate sealing lip of radial oil seal with oil
Press in radial oil seal flush with Special
Tools 11 1 273 and 11 1 271



11 14 605 REPLACING RADIAL OIL SEAL IN CLUTCH END COVER - Transmission Removed

Remove flywheel 11 22 000
Drain engine oil
Loosen oil pan bolts
Pry off gasket carefully with a knife in area of
end cover/oil pan joint
Unscrew end cover
Press radial oil seal out of end cover

Installation

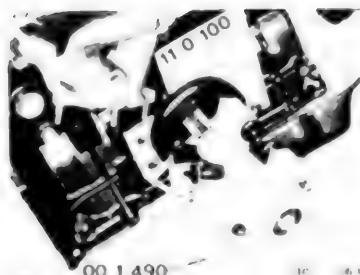
Replace gasket
If oil pan gasket was damaged, remove oil pan
11 13 000

Apply a coat of brush-on universal sealing
compound / Three Bond Silicone 1207** on
end cover/oil pan joint
Use Special Tool 11 2 213 to avoid damaging
the radial oil seal

Press in radial oil seal with Special Tools
11 1 260 and 00 5 500
In contradiction to the standard seal which had
been installed flush, install the new radial oil
seal with approx. 1 to 2 mm (0.039 to 0.079")
offset toward the inside
Lubricate sealing lip with oil

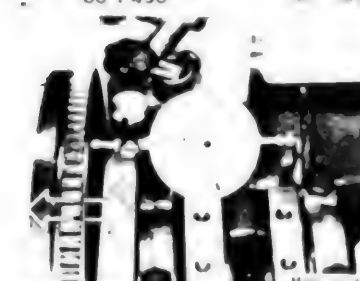
** Source HWR

11-8

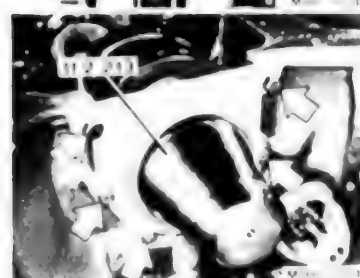


11 21 000 REMOVING AND INSTALLING CRANKSHAFT

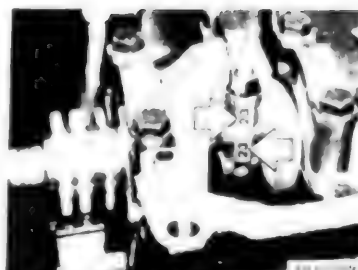
Remove engine 11 00 050
Unscrew engine mounts
Mount crankcase in assembly stand 00 1 490
with Special Tool 11 0 100



Remove clutch 21 21 000
Remove cylinder head 11 12 100
Remove timing chain 11 31 051
Remove oil pump 11 41 000
Check axial play* before removing the crankshaft
Max. Permissible Play Exceeded
Check or replace thrust bearing

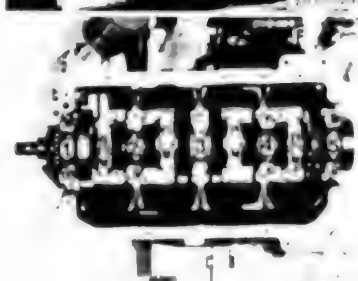


Remove flywheel 11 22 000
Unscrew end cover
Replace gasket
Use Special Tool 11 2 213 to avoid damage on the radial oil seal
Cut off gasket on oil pan sealing surface



Unscrew conrod bearing caps

Replace conrod bearing shells and check conrod bearing play, see 11 24 571
Pair numbers (0 99) must be the same on connecting rods and caps
Tightening torque*



Unscrew crankshaft bearing caps and lift out crankshaft

Bearing cap no. 1 is on sprocket end
Install bearing shells and check bearing play see 11 21 531

Measure axial play after installing crankshaft
loosen thrust bearing no. 3 again
Center thrust bearing by applying knocks from a plastic hammer on front and rear ends of the crankshaft
Tighten thrust bearing to specifications
Check axial play*

If crankcase is replaced, clean oil and water bores again thoroughly to remove casting sand

* See Specifications

* See Specifications

11-9

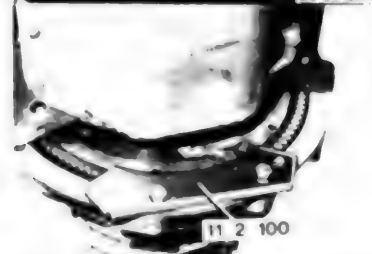
11 21 120 REMOVING AND INSTALLING PULLEY ON CRANKSHAFT

Detach reinforcement plate



30 11 014

Hold flywheel with Special Tool 11 2 100



11 2 100

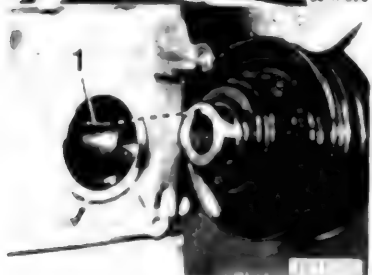
30 11 026

Unscrew nut on pulley
Pull off pulley
Installation
Tightening torque*



30 11 028

Installation
Check that woodruff key (1) is positioned
correctly



* See Specifications

11-10

11 21 501 REPLACING CRANKSHAFT - Crankshaft Removed -

Note:
A replacement crankshaft is supplied complete with corresponding bearing shells for main and conrod bearings.

Crankshaft is surface treated and may only be reground in the factory.
Reground crankshafts are marked with stripes of paint.

Conrod Bearing Journal (A)
1 paint stripe Size 1 *
2 paint stripes Size 2 *

Main Bearing Journal (B)
1 paint stripe Size 1 *
2 paint stripes Size 2 *

Transferring Sprocket
Lift out woodruff key (1)
Pull off sprocket with Special Tool 11 2 000

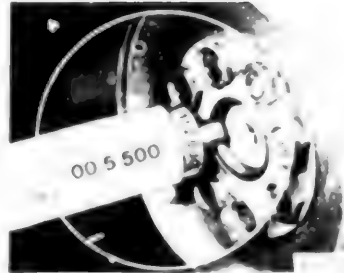
Preparation:
Heat sprocket to max. 200 °C (390 °F) for installation.

Cars with Manual Transmission:
Install pilot bearing for the transmission main shaft.

Installed Order:
Ball bearing (1), cover (2), felt ring (3) and capsule (4).

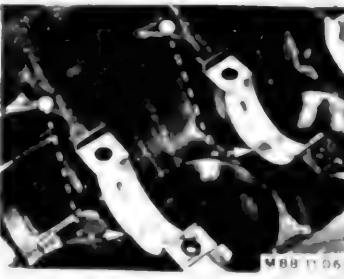
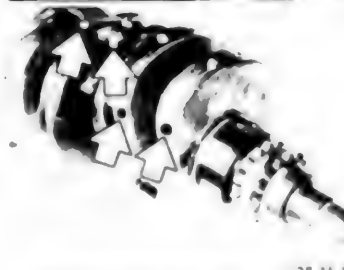
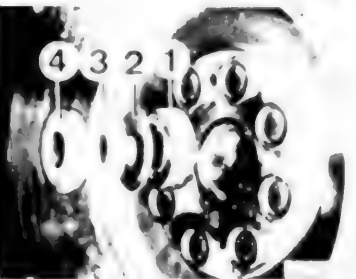
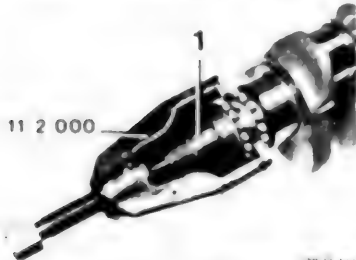
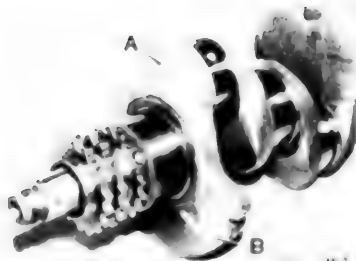
Insert cover (2) with embossment facing out.

* See Specifications



Fill bore in crankshaft with approx. 1 gram (0.035 oz.) of lubricating grease.
Drive in pilot bearing with Special Tools 11 2 030 and 00 5 500.

Replacement crankshafts are only supplied with bearing shells of double classification.
A crankshaft is marked with red or blue paint because of the main bearing journal tolerances.



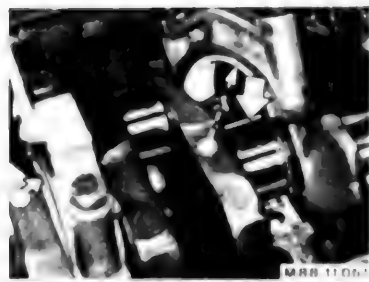
1 = Bearing shell 1-2-4-5
2 = Bearing shell 3 (pilot bearing)

The color code is located on the side of a bearing shell.

Check the ground size of main bearing journals.

Installing Instructions:
Only place bearing shells with "red" marks in the crankcase (regardless of the old color code mark on the crankcase).
Install bearing shells in bearing caps depending on the color code of the crankshaft main bearing journals - "red" or "blue".

11-10a



Install crankshaft
Place Type PG-1 Plastigage on crankshaft wiped clean of oil and tighten bearing caps with the correct torque*. Do not turn the crankshaft.

Source of Supply for Plastigage:
CARTOOL
Alfred-Brehm-Str. 5
D-8070 Ingolstadt



Remove bearing caps
Read bearing play* by measuring the width of the flattened Plastigage with help of the supplied scale.
Correct the bearing play by installing new bearing shells, bearing shells of a different machined size or with different color code marks.

Survey of Color Code Shaft Diameter Bearing Shell Thickness*

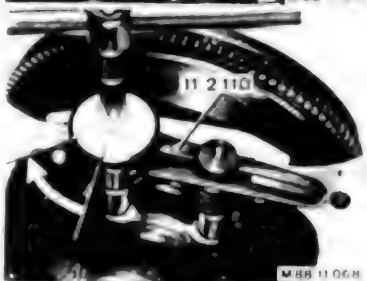
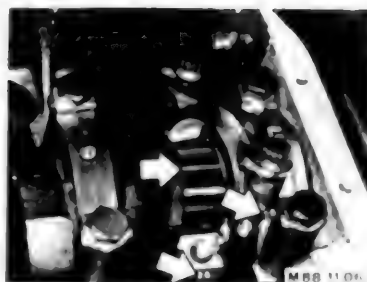
Double Classification Color Codes:
Rt = red
Bl = blue

- 1 Crankshaft diameter
- 2 Bearing play
- 3 Bearing shell thickness
- 4 Console diameter

Replacing Conrod Bearing Shells:
Red or blue conrod bearing shells are installed standard depending on the color code mark on the connecting rod for a pertinent crankshaft ground size.

Only install the red bearing shells of a pertinent ground size supplied with a replacement crankshaft.

* See Specifications



Place Type PG 1 Plastigage on a crankshaft wiped clean of oil in BDC position.
Connecting rods and caps are marked with the same pair number (0...99).
All pair numbers are located on one side in an engine.
Mount conrod caps.
Tightening torque:
Source of Supply for Plastigage
CARTOOL
Alfred-Brehm-Str. 5
D-8070 Ingolstadt

Important!
Do not turn connecting rods or the crankshaft.
Remove bearing caps.
Read bearing play* by measuring the width of the flattened Plastigage with help of the supplied scale.
Correct the bearing play by installing new bearing shells, bearing shells of a different machined size or with different color code marks.
Replace conrod bolts for final installation and tighten the conrod bearing caps.
Tightening torque*.

* See Specifications



11-10b

11 21 531 REPLACING CRANKSHAFT MAIN BEARING SHELLS - Engine Disassembled -

A crankshaft is marked with red or blue paint depending on main bearing journal tolerances.

- 1 = Bearing shell 1-2-4-5
- 2 = Bearing shell 3 (pilot bearing)

Color code mark is located on the side of a bearing shell

Check ground size of main bearing journals

Install bearing shells in crankcase with same color code as the dot of paint on the console.
Install both bearing shells according to the crankshaft color code, if the color code mark on the crankcase is washed off.
Install bearing shells in bearing caps with the same color code as for the crankshaft.

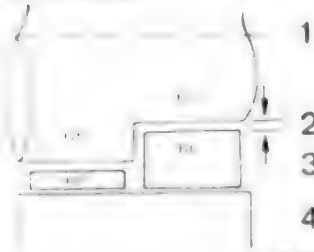
Install crankshaft.
Place Type PG-1 Plastigage on crankshaft wiped clean of oil and tighten bearing caps with correct torque*.
Do not turn the crankshaft.

Source of Supply for Plastigage:
CARTOOL
Alfred-Brehm-Str. 5
D-8070 Ingolstadt

* See Specifications



Remove bearing caps.
Read bearing play* by measuring the width of the flattened Plastigage with help of the supplied scale.
Correct bearing play by installing new bearing shells, bearing shells of different machined size or with different color code.



Survey of Color Code Shaft Diameter
Bearing Shell Thickness*

Double Classification Color Codes
RT = red
BL = blue

- 1 Crankshaft diameter
- 2 Bearing play
- 3 Bearing shell thickness
- 4 Console diameter

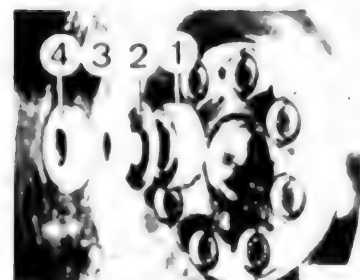
* See Specifications

11-11



11 21 571 REPLACING PILOT BEARING IN CRANKSHAFT

Remove clutch 21 21 000.
Pull out ball bearing with Special Tool
11 2 010.



Installed Order

- 1 Ball bearing
- 2 Cover
- 3 Felt ring
- 4 Capsule

Install cover (2) with stamp facing out



Pack bore in crankshaft with approx. 1 gram
of lubricating grease.
Drive in pilot bearing with Special Tools
11 2 030 and 00 5 500

11-12



11 22 000 REMOVING AND INSTALLING FLYWHEEL

Remove clutch 21 21 000
Hold flywheel with Special Tool 11 2 160
Unscrew bolts and take off flywheel

Installation:

Clean tapped bores

Install washer (1)

Replace and install expansion bolts with Loctite No. 270**

Important:

Only coat threads of bolts

Tightening torque*

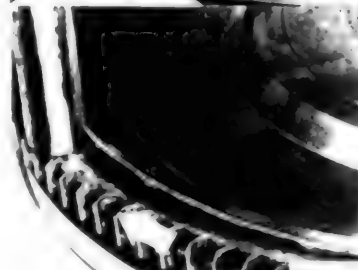
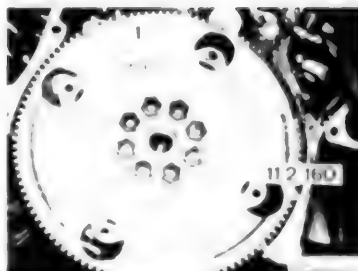
Check axial runout* of flywheel



Friction surface may be machined to minimum thickness A*
If machining the friction surface reduces distance "h" to zero, flange surface (distance "h") must be machined



* See Specifications
** Source: HWB



11 22 051 REPLACING DRIVE PLATE FOR TORQUE CONVERTER

Remove transmission 24 00 020
Hold flywheel with Special Tool 11 2 160
Unscrew expansion bolts

Replace drive plate (1)

Installation:

Clean tapped bores

Replace expansion bolts and install with Loctite No. 270**

Important:

Only coat threads of bolts

Tightening torque*

11 22 541 REPLACING STARTER GEAR RING

Drill a 6 mm (0.236") dia. hole approx. 8 mm (0.315") deep below a tooth gap to make breaking the gear ring easier

Break gear ring at drilled point with a chisel

Installation:

Heat new starter gear ring to 200 - 230° C (395 to 445° F), checking temperature with a thermocolor pencil

Tooth bevel faces engine

Install starter gear ring to fit tight with a brass mandrel

* See Specifications
** Source: HWB

11 - 13



11 24 521 REPLACING CONNECTING RODS PISTONS REMOVED

Important!

Only install connecting rods of same weight class in one engine.
Weight class is stamped in machined conrod cap surface or indicated by a color code.
Connecting rods may not be machined.



Piston pin must slide through conrod bushing under light pressure.
Install conrod bearing shells 11 24 571



11 24 571 REPLACING CONNECTING ROD BEARING SHELLS ENGINE DISASSEMBLED

Install conrod bearing shells in connecting rods and conrod bearing caps.
Shells with Double Classification.
Install red or blue conrod bearing shells according to color code on connecting rod.

Important!

Check machined size (conrod bearing diameter).



In BDC position place Plastigage Type PG 1 on a crankshaft wiped clean of oil.
Connecting rods and conrod bearing caps are marked with identical pair codes (0 - 99).
Pair codes must always be on one side in an engine.
Mount conrod bearing caps.
Tightening torque*.
Source for Plastigage:
Cartool
Alfred Brehm Str. 5
D-8070 Ingolstadt



Important!

Don't turn connecting rods or crankshaft.
Take off bearing caps.
Read bearing play* on supplied scale by measuring width of flattened Plastigage.
Correct bearing play by installing new bearing shells, bearing shells of different machined size or with different color code.
For final installation, replace conrod bearing cap bolts and tighten bearing caps.
Tightening torque*.

* See Specifications.

11-14

11 25 000 REMOVING AND INSTALLING PISTON

Remove engine

Take off cylinder head, oil pan and oil pump
Unscrew control bearing cap and press out piston with connecting rod upwards

Important!

Mark installed position of connecting rod to crankshaft, if conrod bearing shells do not have to be replaced

Remove circlip (1)

Press out piston pin

Installation

Piston pins and pistons are matched and must not be mixed up

Important!

In case of excessive play between piston pin and conrod bush (which sounds like acceleration knock) check conrod bush diameter and if necessary, replace connecting rod or bush
Install connecting rod, see 11 24 521

Only install a piston of same make and same weight class

Weight class is die stamped with "e" or in piston crown

Important!

Check machined size (piston diameter)*

Identification

Type	E*	Piston Bowl Height (mm)	Dia (mm)
M 10 B 18 V	9.5	4.5	89
M 10 B 18 L			
M 10 B 18 L A/C/S	9.5	4.8	89
M 10 B 18 L U	9.0	3.6	89
since 4/85	8.2	1.5	89

Check piston installed clearance*

Engine	Make	Measuring Point A = mm
M 10 B 18	Mahle	14.00
(light alloy piston)	KS	30.85
	Alcan	15.50

* See Specifications

Set internal calipers to zero on micrometer with the measured piston diameter

Measure cylinder bore with internal calipers at bottom, centre and top in forward and rotational directions

Check piston installed clearance*

Lubricate piston and piston rings with oil
Offset piston ring end gaps by 120°
Compress piston ring with Special Tool 11 2 260

Install piston that arrow faces timing chain

* See Specifications

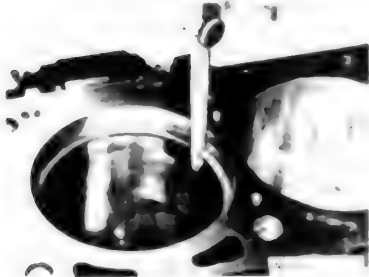
11- 15



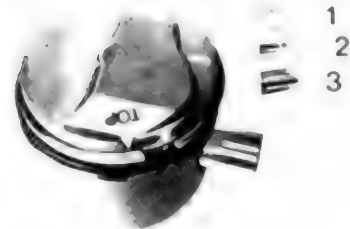
11 25 651 REPLACING PISTON RINGS OF ONE PISTON - Piston Removed

Measure side clearance* of piston rings

28 11 1467



Remove piston rings and check end clearance*



Installation
Install piston rings with word "TOP" facing the piston crown

- 1 Plain compression ring
- 2 Taper faced compression ring
- 3 Slotted oil scraper ring

Note
Identification can no longer be seen on used piston rings
Lay piston rings aside in correct sequence and installed position

* See Specifications

11- 16

11 31 000 REMOVING AND INSTALLING CAMSHAFT

Remove cylinder head 11 12 100
Mount cylinder head in Special Tool 11 1 040

Unscrew oil line
Installation
Check installed position of seals
Tightening torque*

M 10 B 18 V
Unscrew fuel pump
Installation
Check gaskets and insulating flange, replacing if necessary
Pull out plunger partially

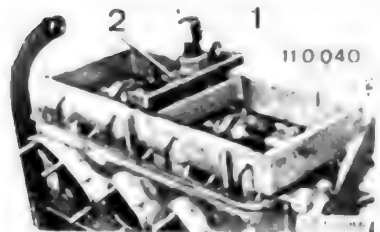
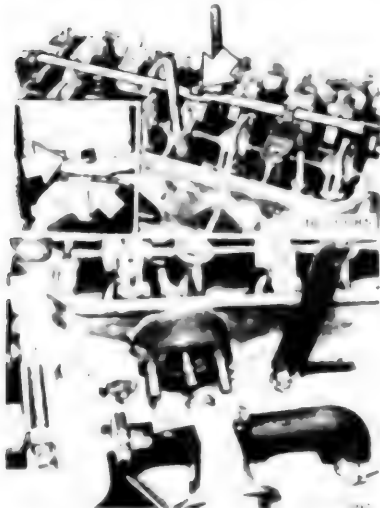
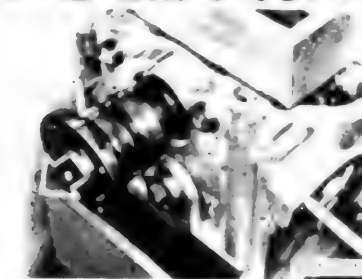
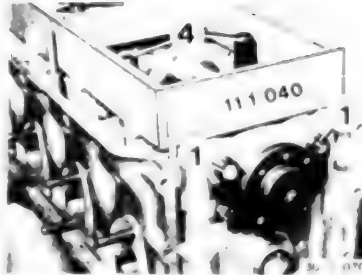
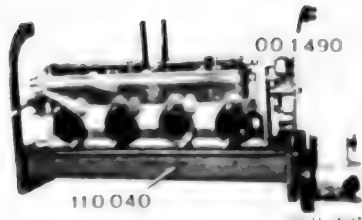
Adjust clearance of all valves to maximum value
Mount Special Tool 11 1 040 and apply pressure on rocker arms
Caution!
Pressure bolt (1) is off center
Apply tensioning bar (2) with short end facing the exhaust manifold, to avoid contact between valve heads
Installation
Adjust valve clearance 11 34 004

* See Specifications

Insert dowel pins (4) and unscrew guide plate
Installation
Replace loose plugs (1) and install with Loctite No. 270**
Camshaft must still turn easily after installing the guide plate

Pull out camshaft carefully
Installation
Turn camshaft in such a manner that notch on camshaft flange is aligned with cast boss on cylinder head, before removing the special tool
Camshaft Identification
2 - 264^Q standard version

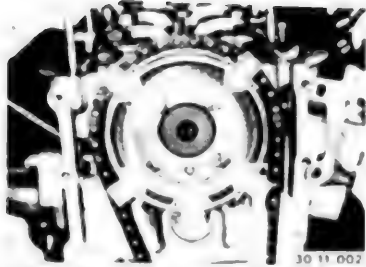
** Source: HWR



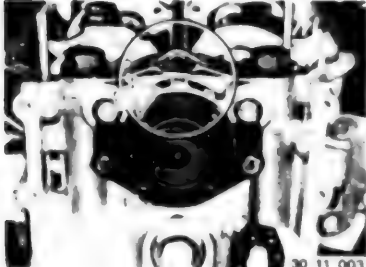
11-17

11 31 051 REPLACING TIMING CHAIN

Remove upper timing case cover 11 14 100
 Remove lower timing case cover 11 14 120
 Set cylinder no. 1 to TDC
 Unscrew sprocket
Important
 Never crank engine after removing chain



30 11 002



30 11 003

Important
 Install timing chain that notch in camshaft flange is aligned with cast boss on cylinder head
 Cylinder no. 1 is at TDC
 Tightening torque*



30 11 004

Take timing chain off of lower sprocket and guide carefully out of guide rail
Note
 Timing chain is stretched

* See Specifications

11-18

11 31 061 REPLACING SET OF TIMING CHAIN SPROCKETS

Remove timing chain 11 31 051
Single Piece Oil Pan
Remove oil pan 11 13 000
Unscrew sprocket on oil pump
Remove woodruff key (1)
Take off chain

11 2 000

All Models
Pull off sprocket with Special Tool 11 2 000
Installation:
Heat sprocket to approx. 80° C (175° F)

Installation:
Chain must be tightened to give under light thumb pressure applied midway between two pulleys

Double Piece Oil Pan
Remove oil pan lower section 11 13 020
Unscrew sprocket (1) on oil pump
Take off chain

Adjust chain tightness with a shim
Inspection:
Check position of oil bore in shim

Remove lockwasher, swing tensioning rail toward inside and remove

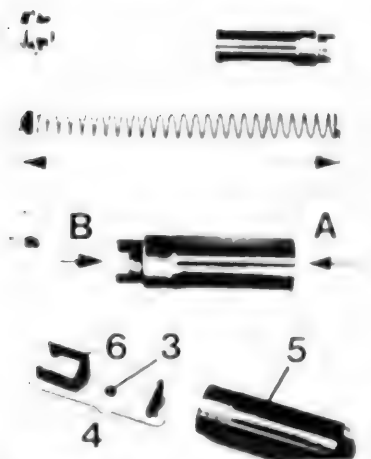
11-19



11 31 090 REMOVING AND INSTALLING CHAIN TENSIONER PISTON

Unscrew plug (1)
Caution!
 Strong spring force
 Remove spring and piston
Installation:
 Replace seal (2)

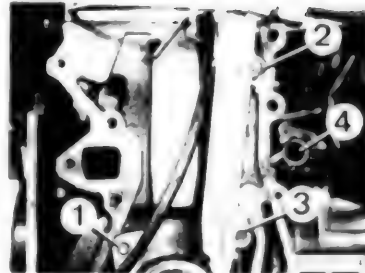
Installation:
 Check spring length*
 Tapered end of coil spring faces plug



Checking Piston
 Check free movement of ball (13) by shaking
 Check function of valve by blowing air:
 in direction A - closed and
 in direction B - opened
 If applicable, drive valve (4) out of sleeve (5)
 and clean
 Make sure vent slots (6) are not clogged

To bleed piston, remove cylinder head cover 11 12 000.
 Loosen plug (1) and remove tensioning rail (6)
 back and forth until oil runs out at plug (1) and
 resistance can be felt
 Points Causing Unusual Chain Noise
 a) Piston bled insufficiently
 b) Piston seized
 c) Vent slots clogged
 d) Ball valve in piston malfunctions
 e) Spring force excessive or insufficient

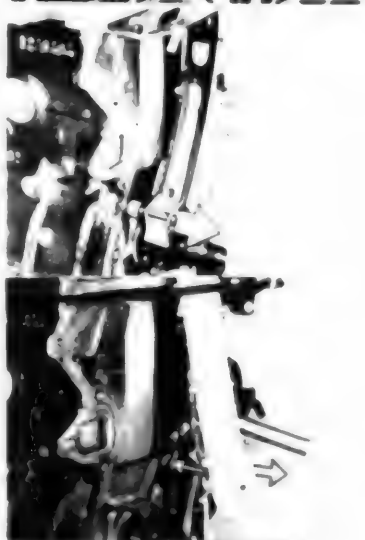
* See Specifications



11 31 601 REPLACING TENSIONING RAIL GUIDE RAIL TIMING CHAIN REMOVED

Remove circlips (1 - 3)
 Disconnect water pipe (4) on holder

Swing in and remove tensioning rail



Pull off guide rail on bottom bearing pin

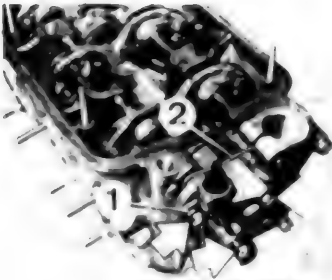


Swing guide rail aside and remove

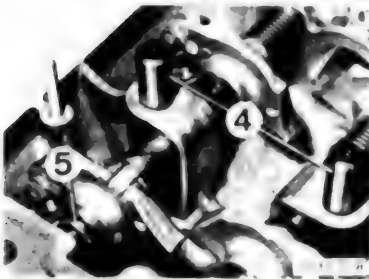
11-20

11 33 020 REMOVING AND INSTALLING ROCKER ARM SHAFTS

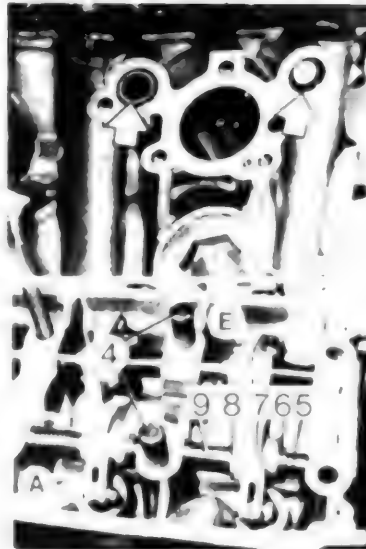
Remove camshaft 11 31 000
Unscrew distributor flange
Installation:
Replace seal (1) and gasket (2)



Push back rocker arms and thrust ring
Remove snap rings (5)
Remove dowel pin (4)



Drive out rocker arm shafts with Special Tool
11 3 050
Installation:
Replace worn shafts



Important:

Rear end of rocker arm shaft for intake side . . . open
Rocker arm shaft on exhaust side must be closed
Replace missing and install **new** or loose old plugs with Loctite No. 270**

Installed Order:

Spring (9), washer (8), rocker arm (7), thrust ring (6) and snap ring (5)

A - Exhaust side

E - Intake side

Align rocker arm shafts that cylinder head bolts fit in openings

Install dowel pins (4)

Important:

The new short springs (9) may be installed together (mixed) with the conventional long springs (9)

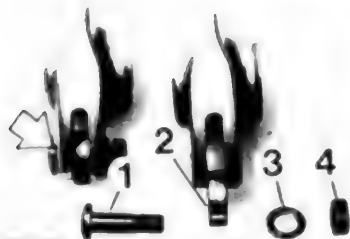
** Source: MVR

11-21



11 33 031 REPLACING ROCKER ARMS

Remove rocker arms 11 33 020
Replace worn rocker arms or rocker arms with loose slides.
Loose slides will be noticed as excessively loud valve noise.



Transfer setscrew (1), eccentric (2), washer (3) and nut (4) to new rocker arm.
Replace a worn eccentric.

important
Setscrew and nut have M 6 x 0.75 fine threads.
Bore faces out and thick side down.
Bevelled side of setscrew faces tab on rocker arm.



11 34 004 ADJUSTING VALVE CLEARANCE

Remove cylinder head cover 11 12 000.
Crank engine with Special Tool 11 3 110.

Adjusting order is same as firing order (1 3 4 2) in compression top dead center (TDC).
Adjust valve clearance* between valve and eccentric after loosening nut (1).

Tighten nut (1) with Special Tools 11 1 150 and 00 2 050.
Tightening torque*.



11 34 509 CHECKING ALL VALVES FOR LEAKS CAMSHAFT REMOVED

Spark plugs remain installed.
Fill combustion chamber with gasoline outdoors or indoors while conforming with fire prevention measures.
If gasoline runs past the valves, inspect valves and valve seats.
Remove and install valves 11 34 550.
Machine valve seats 11 12 607.

* See Specifications.

11-22

11 34 550 REMOVING AND INSTALLING VALVES - Rocker Arm Shafts Removed -

Place Special Tool 11 0 047 (tray) in Special Tool 11 1 040

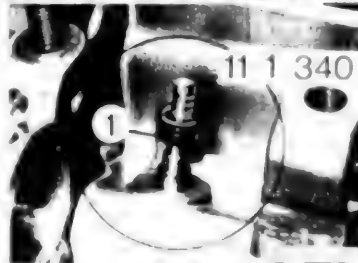
Press down on valve springs with Special Tool 11 1 040 and remove collets

Remove upper spring retainer, valve springs and lower spring retainer
Take tray out of special tool fixture and pull out valve

Installation:
Only install valve springs with same color code wire gauge size and length
Lubricate valve guide and valve stem with oil



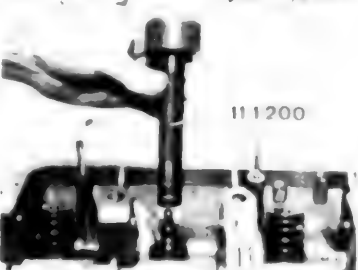
Pull off valve stem seal with Special Tool 11 1 250



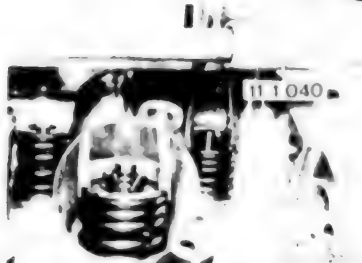
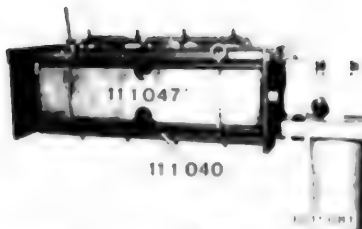
Install valve
Use Special Tool 11 1 340 to avoid damaging valve stem seal
Lubricate valve stem seal (1) with oil and install
Special Tool Source
Cartool
Alfred Brehm Str. 5
D-8070 Ingolstadt

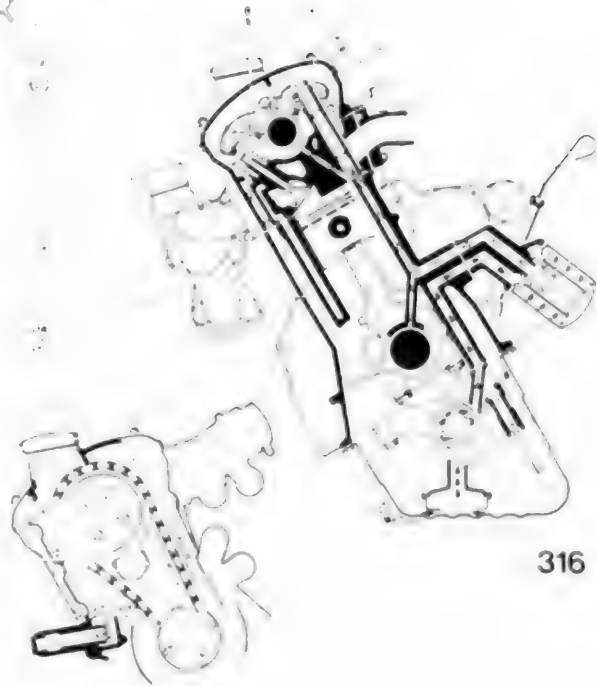
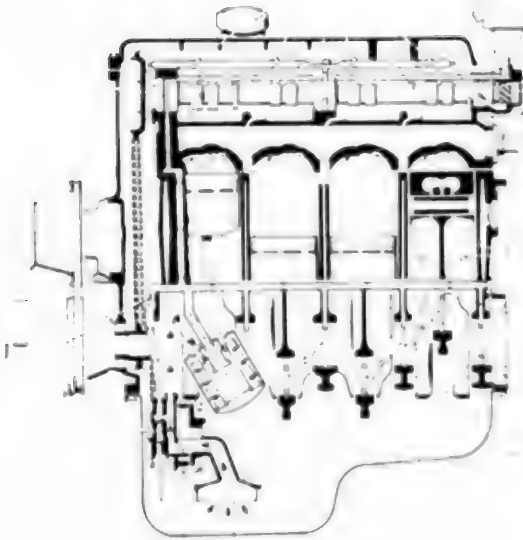


Press on valve stem seal against stop with Special Tool 11 1 090 when diameter A 14.0 ± 0.2 mm (0.551 - 0.008")
or
Special Tool 11 1 070 when diameter A 14.3 ± 0.2 mm (0.563 - 0.008")



New, improved valve stem seals with grooves on the inside are pressed on by hand with Special Tool 11 1 200.
Special Tool 11 1 200 has two diameters for 7 mm (0.276") and 8 mm (0.315") valve stem seals





316 11 362

ENGINE OIL CIRCUIT

Unfiltered oil
Filtered oil

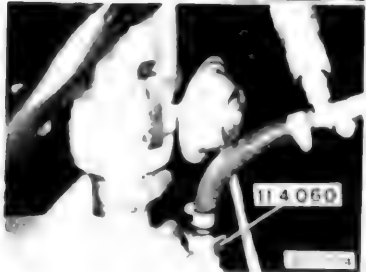
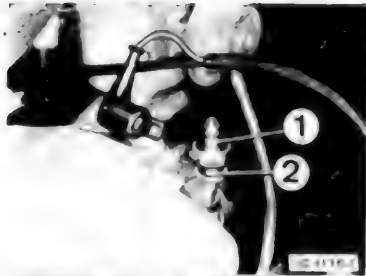
- 1 Oil pan
- 2 Intake with filter screen
- 3 Oil pump
- 3a Pressure relief valve
- 4 Oil filter
- 4a Safety valve
- 5 Main distribution bore
- 6 Oil bore in cyl. head
- 7 Camshaft bearing
- 8 Rocker arm shaft
- 9 Rocker arm bearing (intake valves)
- 10 Oil pressure transmitter
- 11 Camshaft bearing
- 12 Rocker arm bearings (exh. valves)
- 13 Camshaft bearing
- 14 Oil spray tube

- 15 Valve guide
- 16 Overflow from cylinder head
- 17 Crankshaft bearing
- 18 Conrod bearing
- 19 Spray oil
- 20 Pocket/cham lubrication
- 21 Oil sump/distributor drive
- 22 Overflow bore
- 23 Oil drain bore
- 24 Oil filler neck
- 25 Oil dipstick
- 26 Oil drain plug

11-24

11 40 000 CHECKING ENGINE OIL PRESSURE

Pull off wires on oil pressure switch
Unscrew oil pressure switch (1)
Installation
Check seal (2), replacing if necessary

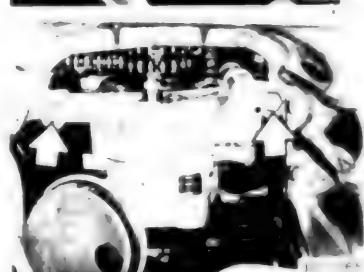


Screw in Special Tool 11 4 060
Connect 10 bar (142 psi) pressure tester of
BMW service test unit
Check oil pressure*

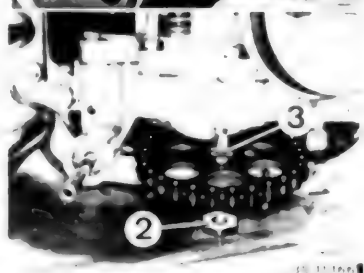


11 41 000 REMOVING AND INSTALLING OIL PUMP

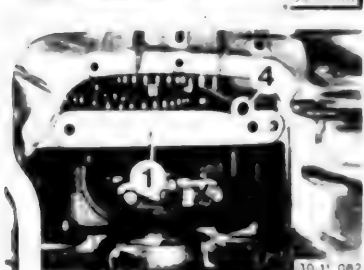
Remove oil pan lower section 11 13 020
Unscrew nut (2) and take off sprocket



Unscrew oil pump



Installation
Install shim (3)
Tightening torque* for nut (2)

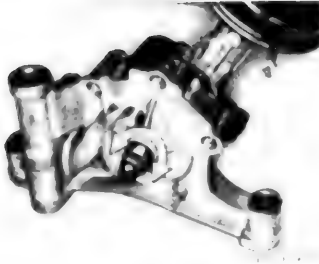


Installation
Check installed position of O ring (4) between
housing and pressure line
Important!
Adjust chain tightness with shim (1) that chain
gives under slight thumb pressure
Check position of oil bore in shim

* See Specifications

* See Specifications

11-25

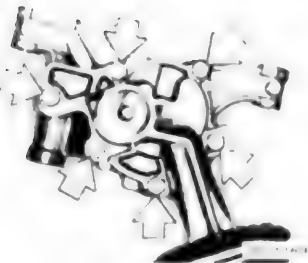


Checking and Servicing:

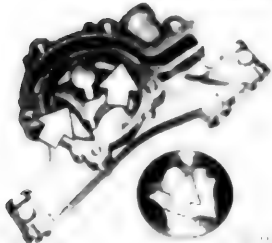
Turn drive shaft to check whether oil pump moves easily



Clean oil filter screen



Disassemble oil pump



Check oil pump for wear
- Scoring in body
- Wear on rotors



Pressure relief valve is located in main bore and regulates the engine oil pressure*, see 11 40 000
Check whether piston (6) moves easily
Check length of spring (7) = 68 mm (2 677")



The 8 bar (114 psi) safety valve regulates the oil pressure in front of the oil filter and prevents oil filter leakage
Check seating of piston (8)
Check length of spring (9) = 44 ± 0.4 mm (1 732 ± 0 016")



Installation

Press in spring (9) and washer (10) with a wrench socket and install circlip (11)

11 41 151 REPLACING OIL PUMP DRIVE CHAIN

Detach oil pan lower section 11 13 020
Remove timing chain 11 31 051
Unscrew nut (2) and take off sprocket

Installation

Check sprockets for wear
Adjust chain tightness, see 11 41 000
Chains with green color code are longer than those with red color code
Tightening torque*,

* See Specifications

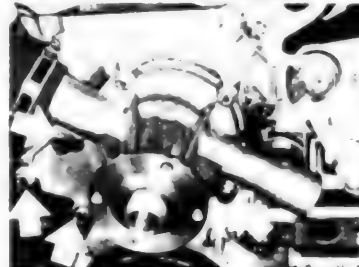
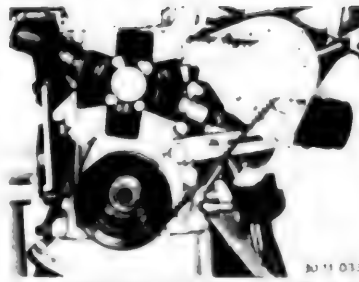
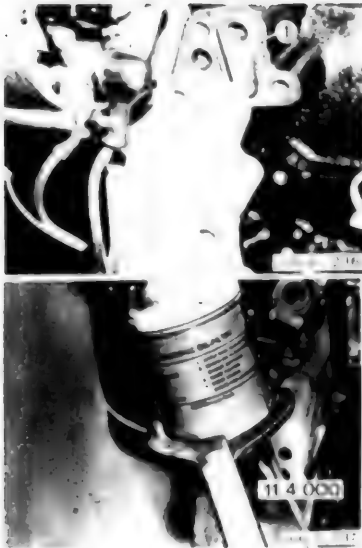
11-26

11 42 020 REMOVING AND INSTALLING/ SEALING COMPLETE FULL FLOW OIL FILTER

Unscrew full flow oil filter on crankcase
Installation:
Replace gasket (1)

11 42 021 REPLACING FULL FLOW OIL FILTER

Unscrew filter with Special Tools 11 4 000
11 4 020
Installation:
Give gasket a light coat of oil
Screw on oil filter by hand until gasket
touches and then tighten filter by hand with
one half turn
Add oil, start engine and check oil level as
well as for leaks
If oil pressure is not built up in engines after
replacing the oil filter cartridge, stop engine,
loosen filter about 90° and tighten again only
after starting engine and waiting until a small
amount of oil runs out at filter (bleeding
procedures)



11 51 000 REMOVING AND INSTALLING WATER PUMP

Remove fan 11 52 000
Loosen alternator
Remove pulley and drive belt
Installation:
Tighten drive belt 12 31 299

Loosen hose clamps
Unscrew water pump
Installation:
Replace gasket

11-27

11 51 502 OVERHAULING WATER PUMP

Pull off hub with Special Tool 00 8 500 from Kukko



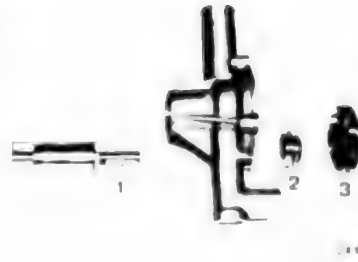
Installation
Distance (A)*

Remove circlip

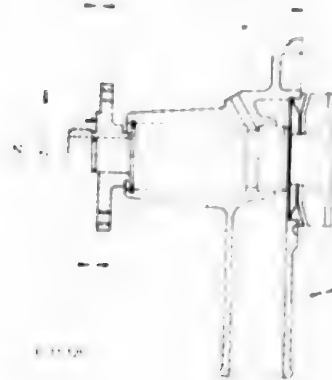
Press impeller off of shaft and water pump bearing out of housing

* See Specifications

Replace bearing (1) and seal (2)
Check impeller (3), replacing if necessary



Installation
Press on impeller with Loctite No. 270**
Distance (B)* must always be held



* See Specifications
** Source HWB

11-28

11 52 000 REMOVING AND INSTALLING FAN

Hold pulley with Special Tool 11 5 030 and unscrew coupling nut (1)
Important!
 Left hand threads - turn nut clockwise to unscrew
 Tightening torque*

Installation

Tighten fan with Special Tool 11 5 040
 40 Nm (29 ft. lbs.) tightening torque is equal to a 30 Nm (22 ft. lbs.) setting on torque wrench

11 52 020 REPLACING FAN CLUTCH

Remove fan - see 11 52 000

Replace fan clutch when

- a) hub has seized (fan of stopped engine cannot be turned or is hard to turn).
- b) fan coupling has axial/radial play or is losing oil

Check switching points* with a Vibrocard***

Unscrew fan mounting bolts and take off fan clutch

11 53 000 REMOVING AND INSTALLING COOLANT THERMOSTAT

Drain coolant
 Loosen hose clamps
 Remove thermostat

Installation

Bleed cooling system - see 17 11 000

Checking Thermostat

Place thermostat in a container filled with water and heat water
 Check opening temperature* and opening travel with a steel ruler
 Opening travel 8 ± 1 mm (0.315 ± 0.039 ")

* See Specifications

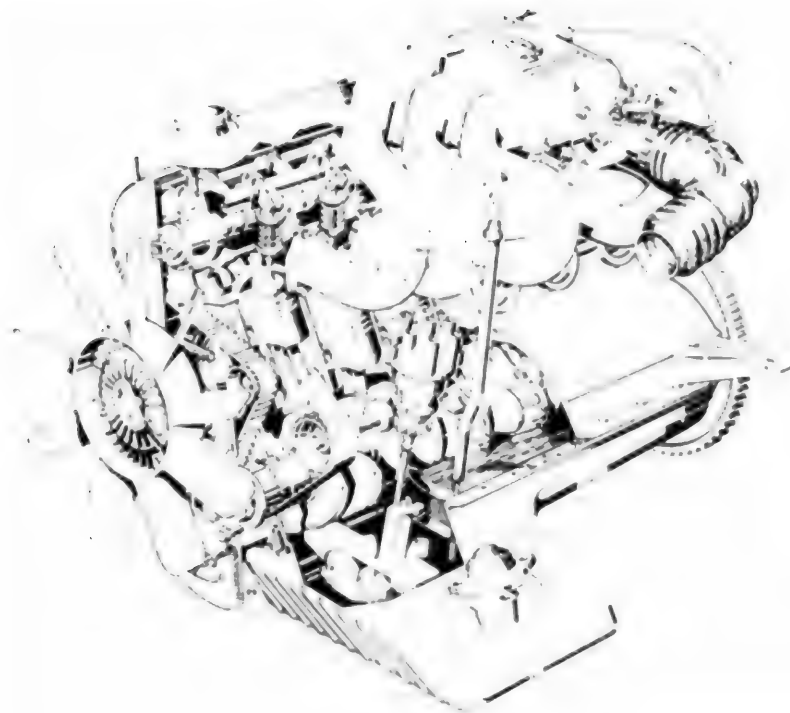
*** See Workshop Equipment Catalog

* See Specifications

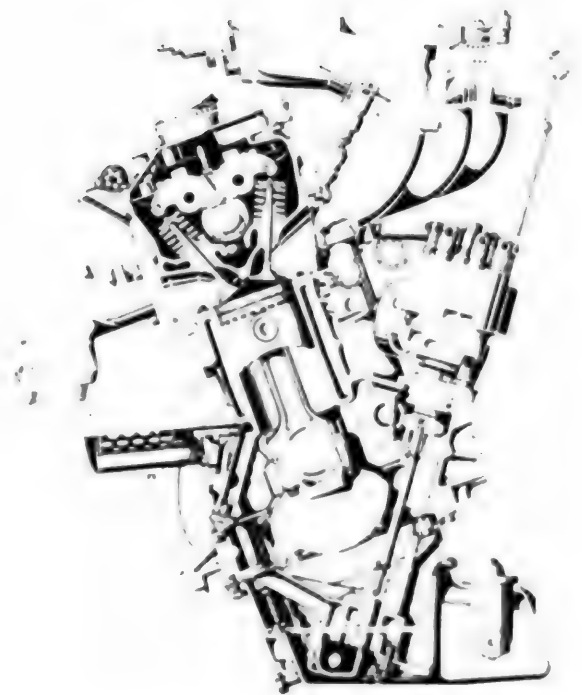
11 Engine M20

11 12 000	Cylinder head cover – remove and install	11- 101
101	Cylinder head gasket – replace	11- 101
240	Radial oil seal in end cover – replace	11- 102
500	Cylinder head – remove and install (engine removed)	11- 103
561	Valve guide – replace (valve removed)	11- 104
595	Valve guide – check for wear	11- 104
600	Valve guide – ream	11- 104
607	Valve seats and valves – machine (cylinder head disassembled)	11- 105
719	Cylinder head sealing surface – grind (cylinder head disassembled)	11- 105
729	Cylinder head – check for cracks in water test (cylinder head disassembled)	11- 105
11 14 175	Front end cover – remove and install	11- 106
180	Radial oil seal in front end cover – replace	11- 107
605	Radial oil seal in clutch end cover – replace (transmission removed)	11- 107
11 21 000	Crankshaft – remove and install	11- 108
501	Crankshaft – replace (crankshaft removed)	11- 109
531	Crankshaft main bearing shells – replace (engine disassembled)	11- 109
571	Pilot bearing in crankshaft – replace	11- 110
11 22 000	Flywheel – remove and install	11- 111
051	Drive plate for torque converter – replace	11- 111
541	Starter gear ring – replace	11- 111
11 23 010	Vibration damper – replace	11- 112
031	Vibration damper hub – replace	11- 112
11 24 521	Connecting rods – replace (pistons removed)	11- 113
571	Connecting rod bearing shells – replace (engine disassembled)	11- 113
11 25 000	Piston – remove and install	11- 114
651	Piston rings of one piston – replace (piston removed)	11- 115
11 31 000	Camshaft – remove and install	11- 116
110	Drive belt – replace	11- 117
11 33 020	Rocker arm shafts – remove and install (distributor engine)	11- 119
020	Rocker arm shafts – remove and install (DME engine)	11- 120
031	Rocker arms – replace	11- 121
11 34 004	Valve clearance – adjust	11- 121
509	Valves – check for leaks (camshaft removed)	11- 121
550	Valves – remove and install	11- 122
11 35 020	Distributor intermediate shaft – remove and install	11- 122
	Engine oil circuit	11- 123
11 40 000	Engine oil pressure – check	11- 124
11 41 000	Oil pump – remove and install	11- 125
110	Pressure safety valve – remove and install	11- 126
11 42 020	Full flow oil filter – replace	11- 126
11 43 101	Guide tube for oil dipstick – replace	11- 126
11 51 000	Water pump – remove and install	11- 127
502	Water pump – overhaul (water pump removed)	11- 128
11 52 000	Fan – remove and install	11- 129
020	Fan clutch – replace	11- 129
11 53 000	Coolant thermostat – remove and install	11- 129
080	Temperature transmitter – replace	11- 129

11-100

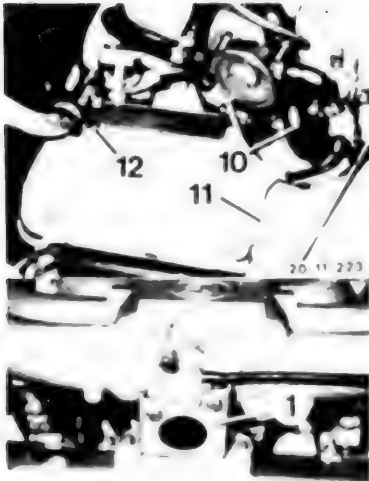


- M 20
 - B
 - 20
 - L
 - M
 - A C S U
 - Z
- Small 6 cylinder
 - Gasoline
 - Displacement (x 100)
 - L Jetronic
 - Motronic
 - Australia Switzerland Sweden USA
 - Catalytic converter (worldwide)



- M 20 B 20 L = BMW 320 i / 520 i
- M 20 B 20 L C S = BMW 320 i / 520 i (low emission)
- M 20 B 20 M Z = BMW 320 i / 520 i (catalytic converter)
- M 20 B 23 L = BMW 323 i
- M 20 B 23 L A C S = BMW 323 i (low emission)
- M 20 B 25 M = BMW 325 i
- M 20 B 25 M Z = BMW 325 i (catalytic converter)
- M 20 B 27 M = BMW 525 e
- M 20 B 27 M U = BMW 325 e / 525 e (catalytic converter)
- M 20 B 27 M Z = BMW 325 e / 525 e (catalytic converter)

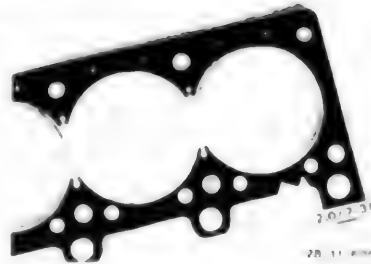
11-101



11 12 000 REMOVING AND INSTALLING CYLINDER HEAD COVER

M 20 B 20 B 23
Pull off hose (10)
Unscrew support (11)
Unscrew clamp (12)

M 20 B 25
Unscrew support (1)



11 12 101 REPLACING CYLINDER HEAD GASKET

Remove cylinder head 11 12 100
Clean sealing surfaces on cylinder head and crankcase, using gasket remover** and a hard wood scraper.
Check levelness with a standard steel ruler, grinding cylinder head sealing surface (see 11 12 719) if necessary.

Installation

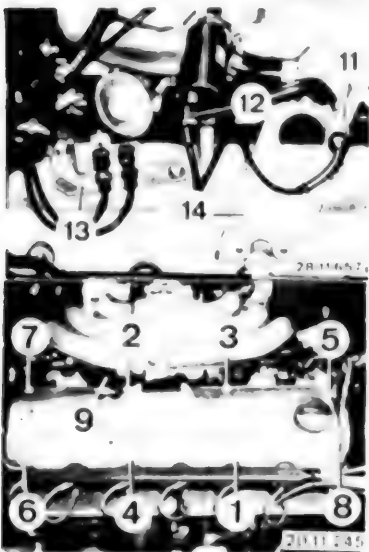
Only use original cylinder head gaskets to guarantee matching of holes and openings for coolant.

Engine Stamped Identification

M 20 B 20	20 2 3 E
M 20 B 23	20 2 3 E
M 20 B 25	2 5
M 20 B 27	2 7

Important!

A 0.3 mm (0.012") thicker gasket can be installed on a reground cylinder head to avoid reduction in size of the combustion chamber. This gasket can also be used to avoid engine knock when proper grade fuel is not available.



M 20 B 27
Pull off plugs (11 and 12) and unscrew holder (13)
Unscrew support (14)

All Models
Disconnect hose (9)
Unscrew nuts (1 - 8) and take off cover.
Installation:
Check gasket, replacing if necessary.
Screw on ground strap with nut (6)
Tighten nuts in order of 1 - 8.
Tightening torque*

* See Specifications

** Source: HWB

11-102

11 12 240 REPLACING RADIAL OIL SEAL IN END COVER

Remove toothed drive belt - see 11 31 110.

M 20 B 20 B 23:
Unscrew adapter.

Unscrew toothed belt sprocket on camshaft.

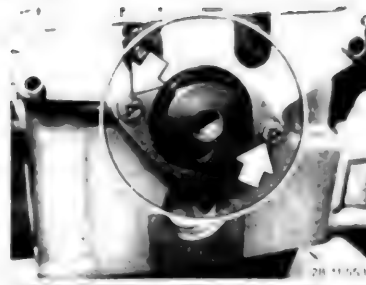
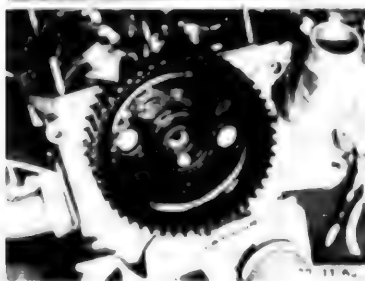
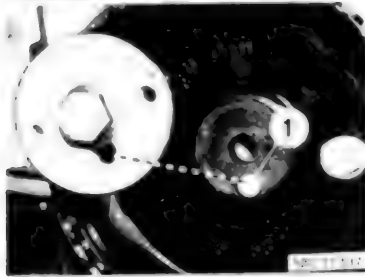
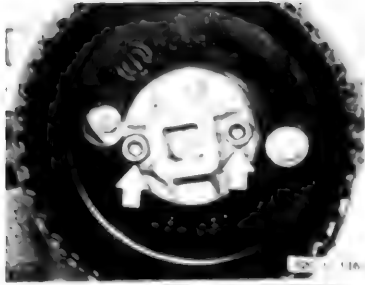
Installation:
Cylindrical pin must be in bore of camshaft.

M 20 B 27 B 25:
Take off toothed belt sprocket

All M 20:
Unscrew cover.

Replace radial oil seal (2) and round cord seal (3)

Installation:
Use Special Tool for installation of the cover.



11-103

11 12 500 REMOVING AND INSTALLING CYLINDER HEAD (Engine Removed)

Remove cylinder head cover - see 11 12 000.
Turn crankshaft to have cylinder no. 1 in TDC - valves of cylinder no. 6 overlap.

Remove drive belt cover.
Loosen bolts (7 and 8).
Push in tensioning roller and tighten bolt (8).

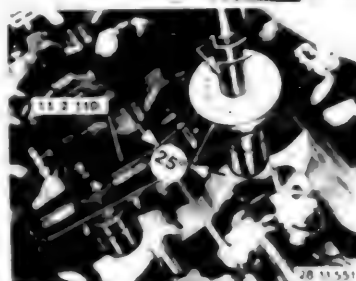
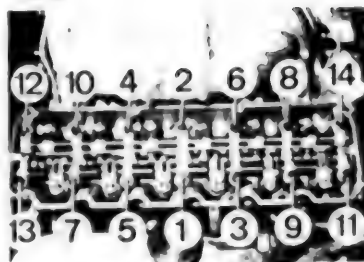
Take drive belt off of the camshaft sprocket.

Caution
Never crank engine after removing the drive belt.

Installation
An used drive belt must always be replaced with a new belt each time the tensioning roller is loosened, regardless of the mileage***.
Replace drive belt - see 11 31 110.

Installation
Turn camshaft that mark on camshaft sprocket points to mark on cylinder head prior to mounting the cylinder head.
Cylinder no. 1 is set to TDC.
Also mount the drive belt in this position.

*** See Service Information of Gr. 11



Unscrew bolts in order of 14 to 1 and take off the cylinder head.

Installation
Replace cylinder head gasket - see 11 12 101.
There must not be oil in cavities (danger of cracking, wrong tightening torque).
Clean and lubricate cylinder head bolts lightly with oil.
Tighten bolts in order of 1 to 14 in three steps.

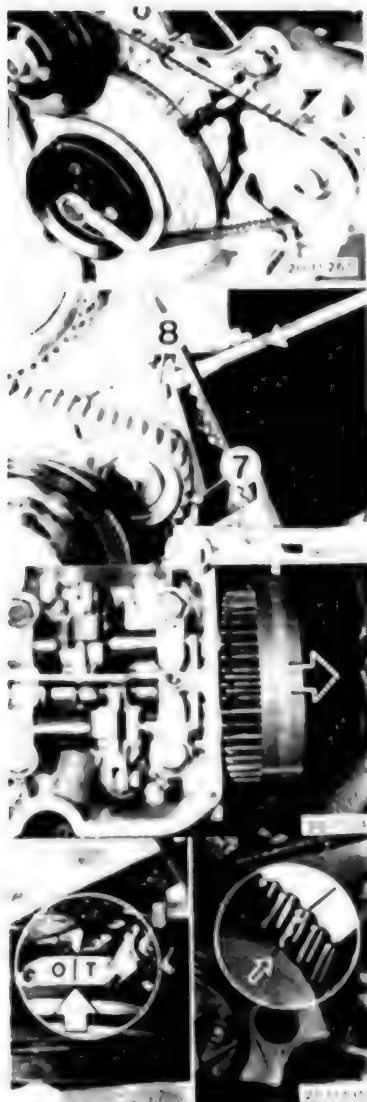
Hexagon Head Bolts (Version A)

- | | |
|--------|----------------------------|
| Step 1 | 40 Nm (29 ft. lbs.) torque |
| | 15 minute settling time |
| Step 2 | 60 Nm (43 ft. lbs.) torque |
| | 25 minute warm running |
| Step 3 | 25° torque angle |

Torx Bolts (Version B)

- Use new bolts!
- | | |
|--------|----------------------------|
| Step 1 | 30 Nm (22 ft. lbs.) torque |
| Step 2 | 90° torque angle |
| Step 3 | 90° torque angle |
- (no settling or warm running time)

Version A can be converted to Version B

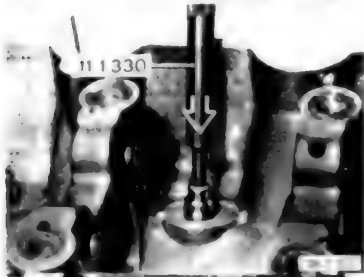


11-104



11 12 561 REPLACING VALVE GUIDE Valve Removed

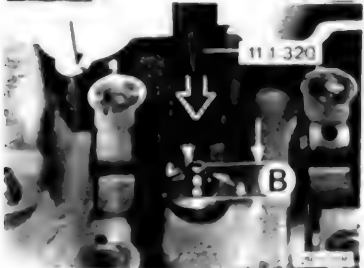
Check valve guide wear* with Special Tool 00 4 300



Drive out valve guide (cold) into combustion chamber with Special Tool 11 1 330



Check bore in cylinder head with Special Tool 00 4 530
If permissible diameter has been exceeded ream out bore A with a standard reamer and install an oversize* valve guide



Heat* cylinder head
Drive valve guide into combustion chamber from the camshaft side with Special Tool 11 1 320
Stepped end of valve guide faces camshaft
Important!
Bore in mandrel determines installed depth
 $B = 14.5 \pm 0.5 \text{ mm } (0.571 \pm 0.020\text{'})$
Ream out valve guide to diameter of $7.4 \text{ mm } (0.2756\text{'})$ with Special Tool 00 4 200
Machine valve seat - 11 12 607

* See Specifications



11 12 595 CHECKING VALVE GUIDE FOR WEAR Valve Removed

To measure amount of wear, install a new valve that end of valve stem is flush with valve guide
Set up dial gage and measure tilt clearance
Max permissible tilt clearance*

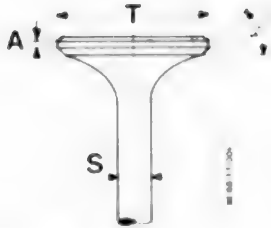


11 12 600 REAMING OUT VALVE GUIDE Valve Removed

If there is excessive clearance between the valve guide and valve stem (see 11 12 595), ream out valve guide and install a repair valve with an oversized stem diameter "S"*. This also requires machining the valve seat, see 11 12 607
Press guide pad (1) on to valve seat and ream out valve guide starting from the combustion chamber side - turn down reamer once

* See Specifications

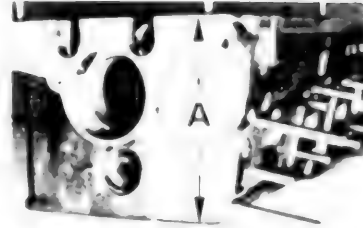
11-105



11 12 607 MACHINING VALVE SEATS AND VALVES Valves Removed

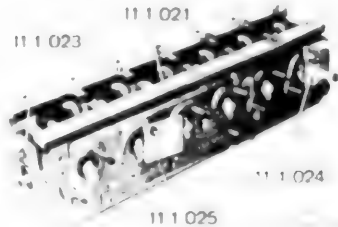
If edge thickness A* is less than specified the valve must be replaced

Machine correction angles* to produce valve seat diameter M* and valve seat width B* after machining the valve seat angle*
Grind in valves with grinding paste and check valves for leaks - 11 34 509



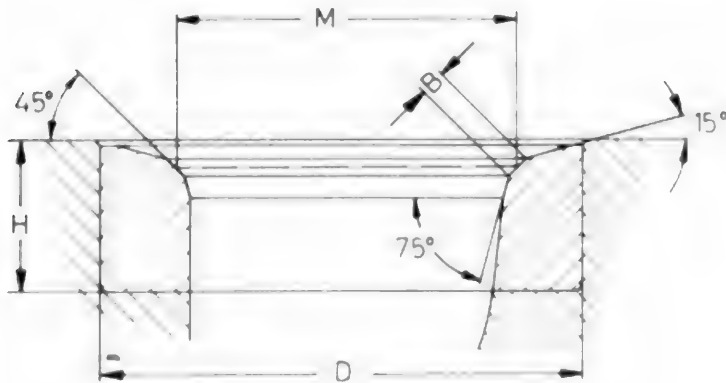
11 12 719 GRINDING CYLINDER HEAD SEALING SURFACE Cylinder Head Disassembled

The total thickness (A) = 125.1 ± 0.1 mm (4.925 ± 0.004") of an original cylinder head must not be reduced by more than 0.3 mm (0.012")
Use a 0.3 mm (0.012") thicker gasket on a reground cylinder head (also refer to 11 12 101)

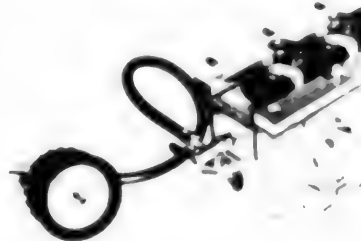


11 12 729 CHECKING CYLINDER HEAD FOR CRACKS IN WATER TEST Cylinder Head Disassembled

Mount Special Tools 11 1 021 on cylinder head (using cylinder head mounting bolts)
Close off water circuit on cylinder head with Special Tools 11 1 023, 11 1 024 and 11 1 025



* See Specifications



Apply compressed air on cylinder head
Testing pressure: 4.5 bar (64 psi)
Place cylinder head in water bath and check for cracks
Note
If necessary, relax water bath with a detergent

* See Specifications

11-106



11 14 175 REMOVING AND INSTALLING FRONT END COVER

Remove radiator - see Group 17
Remove toothed drive belt - see 11 31 110

Single Piece Hub Sprocket:
Hold sprocket with Special Tool 11 2 150.
Unscrew bolt (3).
Take off collar (4).

Installation:
Tightening torque*.

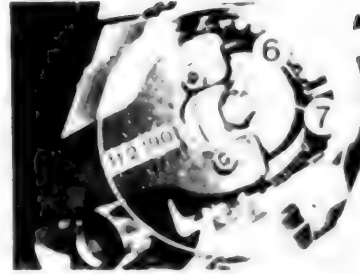
Screw in bolt (3) about three turns.
Pull hub-sprocket off of the crankshaft with help of Special Tools 00 7 501 and 11 2 132.

Important:
Woodruff key.

Double Piece Hub Sprocket
Screw in bolt (3) again.
Pull sprocket off of the crankshaft with help of Special Tools 00 7 501 and 11 2 131.

Important:
Woodruff key.

Installation:
Mount sprocket that the lettering faces forward.



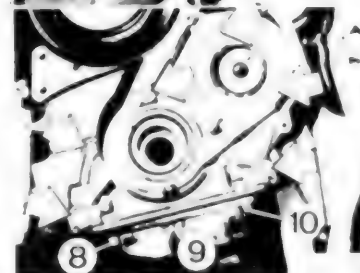
Removing Sprocket on Intermediate Shaft.

Version with Two Tapped Bores in Flange of Intermediate Shaft
Hold sprocket with Special Tool 11 2 190.
Unscrew bolt (6).
Take off washer (7) and toothed drive belt sprocket.



Version with One Tapped Bore

Use Special Tool 11 2 280



Unscrew bolts (8 ... 10).
Only loosen remaining oil pan bolts. Loosen oil pan gasket on end cover carefully with a knife.
Unscrew cover.

Installation:
Remove oil pan and replace gasket (see 11 13 000). If oil pan gasket is damaged.
Coat holes of oil pan gasket with Three Bond Silicon 1207** brush-on universal sealing compound.
Replace gasket.

Check radial oil seal, replacing if necessary.

Important:
Always use Special Tools 11 2 211 (crankshaft) and 11 2 212 (intermediate shaft) for installation of the end cover.



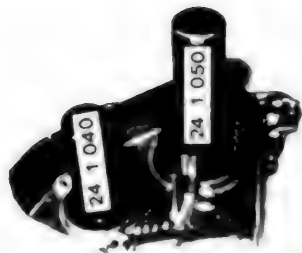
* See Specifications

** Source of Supply: HWB

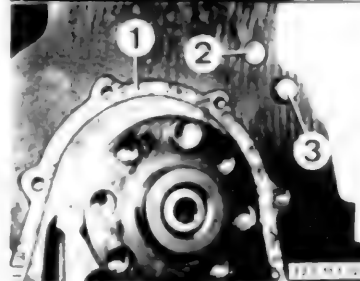
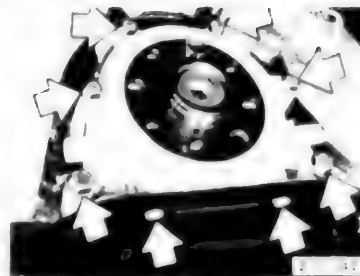
11-107

11 14 180 REPLACING RADIAL OIL SEAL IN FRONT END COVER

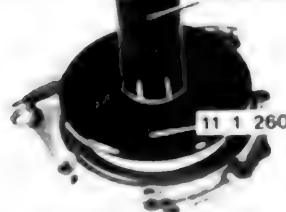
Remove front end cover - see 11 14 175
Press radial oil seal out of cover
Press in new radial oil seal with Special Tools 24 1 050 : 24 1 040
Install new radial oil seals about 1 to 2 mm (0.039 to 0.079") deep in contradiction to the old seals, which were installed flush in standard production
Lubricate sealing lips with oil



M 21 11 050



00 5 500



11 1 260



30 11 027

30 11 028

11 14 605 REPLACING RADIAL OIL SEAL IN CLUTCH END COVER - Transmission Removed -

Remove flywheel - see 11 22 000.
Unscrew oil pan - end cover bolts.
Only loosen remaining oil pan bolts
Loosen oil pan gasket on end cover carefully with a knife.
If the oil pan gasket is damaged, remove oil pan - see 11 13 000.
Unscrew end cover.
Replace gasket (1).

Important!
Check plug (2) of main oil bore for leaks, replacing with new plugs (3) front and rear if necessary
Install plugs with Loctite No 270**

Use Special Tools 11 1 260 and 00 5 500 to press in the radial oil seal.
Install new radial oil seal about 1 to 2 mm (0.039 to 0.079") deep in contradiction to the old seal, which was installed flush in standard production.
Lubricate sealing lip with oil.

Coat joint between end cover and oil pan with Three Bond Silicon 1207** brush-on universal sealing compound.
Use Special Tool 11 2 213 to avoid damaging the radial oil seal.

** Source of Supply: HWB

11-108

11 21 000 REMOVING AND INSTALLING CRANKSHAFT

Remove engine 11 00 050
Mount crankcase in assembly stand 00 1 490
with Special Tool 11 0 120

Remove clutch 21 21 000.
Remove cylinder head 11 12 100
Remove front end cover 11 14 175
Remove oil pump 11 41 000
Check axial play* before removing the crankshaft.
Max. Permissible Play Exceeded
Check or replace thrust bearing.

Remove flywheel 11 22 000
Unscrew end cover
Installation:
Replace gasket
Use Special Tool 11 2 213 to avoid damaging radial oil seal
Cut off gasket on oil pan sealing surface

Unscrew conrod bearing caps
Installation:
Replace conrod bearing shells and measure conrod bearing play, see 11 24 571.
Pair numbers (0-99) must be the same on connecting rods and caps.

* See Specifications



Unscrew crankshaft bearing caps and lift out crankshaft

Installation:

Don't mix up bearing caps
Bearing cap no. 1 is on drive belt end
Bearing no. 6 is the thrust bearing
Install bearing shells and check bearing play see 11 21 531

Installation:

Measure axial play after installing crankshaft
loosen thrust bearing no. 6 again
Center thrust bearing by applying knocks from a plastic hammer on front and rear ends of crankshaft
Tighten thrust bearing to specifications
Check axial play*
If crankcase is replaced, clean oil and water bores again thoroughly to remove casting sand

* See Specifications

11-109

11 21 501 REPLACING CRANKSHAFT - Crankshaft Removed -

Note

A replacement crankshaft is supplied complete with corresponding bearing shells for main and conrod bearings. Crankshaft identification:

Engine	Stroke	Grooves	Code
M 20 B 20	66.0 mm	1	U
M 20 B 23	76.8 mm	-	V
M 20 B 25	75.0 mm	3	X
M 20 B 27	81.0 mm	2	W

Crankshaft is surface treated and may only be reground in the factory.

Reground crankshafts are marked with stripes of paint.

Conrod Bearing Journal (A)

1 paint stripe Size 1
2 paint stripes Size 2

Main Bearing Journal (B)

1 paint stripe Size 1
2 paint stripes Size 2

Cars with Manual Transmission:
Install pilot bearing for the transmission main shaft.

Installed Order:
Ball bearing (1), cover (2), felt ring (3) and capsule (4).

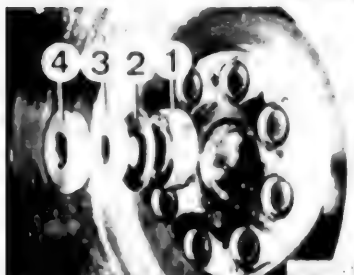
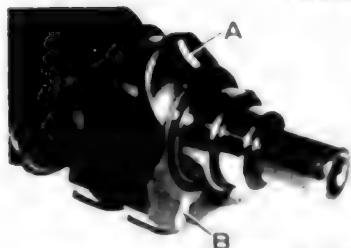
Insert cover (2) with embossment facing out.

Fill bore in crankshaft with approx. 1 gram (0.035 oz.) of lubricating grease. Drive in pilot bearing with Special Tools 11 2 030 and 00 5 500.

* See Specifications



28 11 007



28 11 308



28 11 053



M 88 11 060



M 88 11 061

Crankshaft bearing shells were installed standard with the following color codes for a pertinent ground size:

- Double classification: red blue (old color codes)
- Triple classification: yellow green white (new color codes)

Replacement crankshafts are only supplied with bearing shells of triple classification.

1 = Bearing shell 1-2-3-4-5-7
2 = Bearing shell 6 (pilot bearing)

The color code is located on the side of the bearing shell.

Installing Instructions:

Only place bearing shells with "yellow marks" in the crankcase (regardless of the old color code mark on the crankcase).

Install bearing shells in bearing caps depending on the color code of the crankshaft bearing journals - "yellow-green-white".

Install crankshaft.

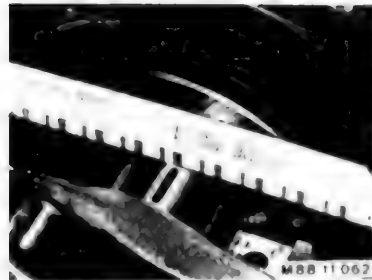
Place Type PG-1 Plastigage on crankshaft wiped clean of oil and tighten bearing caps with the correct torque. Do not turn the crankshaft.

Source of Supply for Plastigage

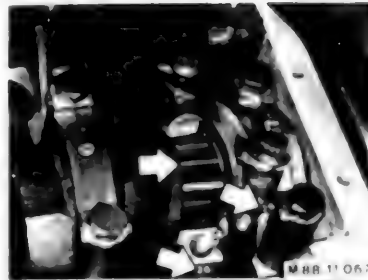
CARTOOL
Alfred-Brehm-Str. 5
D-8070 Ingoisdorf

* See Specifications

11-109a



Remove bearing caps.
Read bearing play* by measuring the width of the flattened Plastigage with help of the supplied scale.
Correct the bearing play by installing new bearing shells, bearing shells of a different machined size or with different color code marks.



Place Type PG-1 Plastigage on crankshaft wiped clean of oil in BDC position and mount the bearing caps that all grooves are on one side.
The pair number (0 ... 99) must be the same on connecting rods and caps.

Source of Supply for Plastigage
CARTOOL
Alfred-Brehm-Str. 5
D-8070 Ingolstadt

Survey of Color Code Shaft Diameter Bearing Shell Thickness*

Triple Classification Color Codes

Ge = yellow

Gn = green

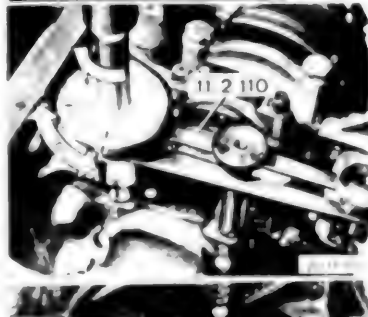
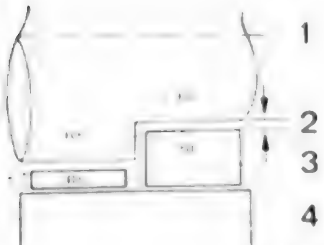
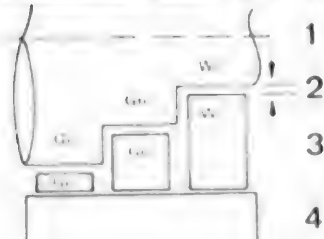
Ws = white

Double Classification Color Codes.

Rl = red

Bl = blue

- 1 Crankshaft diameter
- 2 Bearing play
- 3 Bearing shell thickness
- 4 Console diameter



Tighten bolts in two steps (use old conrod bolts)

Step 1 20 Nm (14.5 ft. lbs.)

Step 2 70° torque angle

Important!

Do not turn the connecting rods or crankshaft.

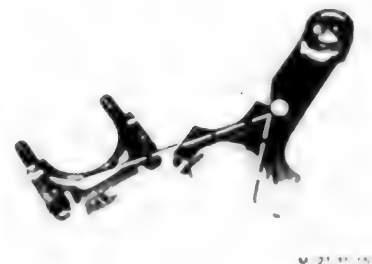
Remove bearing caps



Read bearing play* by measuring the width of the flattened Plastigage with help of the supplied scale.

Correct the bearing play by installing new bearing shells, bearing shells of a different machined size or with different color code marks.

Replace conrod bolts for final installation and tighten the conrod caps in two steps (see above)



Replacing Conrod Bearing Shells.
Red or blue conrod bearing shells are installed standard depending on the color code mark on the connecting rod or crankshaft for a pertinent ground size.

Only install the red bearing shells of a pertinent ground size for a replacement crankshaft.

* See Specifications

* See Specifications

11-109b

11 21 531 REPLACING CRANKSHAFT MAIN BEARING SHELLS - Engine Disassembled -

Crankshaft bearing shells with the following color codes for a pertinent ground size had been installed standard

- Double classification: red blue (old color code)
- Triple classification: yellow green white (new color code)

- 1 = Bearing shell 1-2-3-4-5-7
2 = Bearing shell 6 (pilot bearing)

Color code mark is located on the side of a bearing shell.

Install bearing shells in crankcase with same color code as the dot of paint on the console.

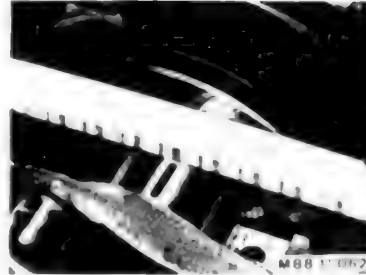
Install both bearing shells according to the crankshaft color code, if the color code mark on the crankcase is washed off.

Install bearing shells in bearing caps with the same color code as for the crankshaft.

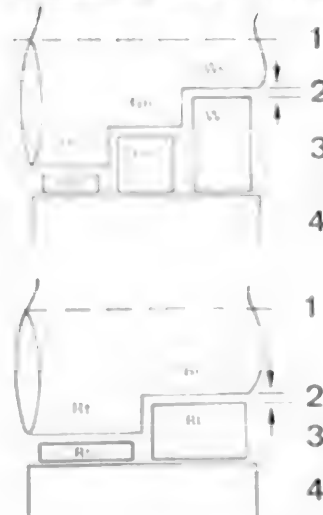
Install crankshaft
Place Type PG-1 Plastigage on crankshaft wiped clean of oil and tighten bearing caps with the correct torque*
Do not turn the crankshaft

Source of Supply for Plastigage
CARTOOL
Alfred-Brehm-Str. 5
D-8070 Ingolstadt

* See Specifications



Remove bearing caps
Read bearing play* by measuring the width of the flattened Plastigage with help of the supplied scale
Correct the bearing play by installing new bearing shells, bearing shells of a different machined size or with a different color code



Survey of Color Code Shaft Diameter
Bearing Shell Thickness*

Triple Classification Color Codes

Ge = yellow

Gn = green

Ws = white

Double Classification Color Codes

Rt = red

Bl = blue

1 Crankshaft diameter

2 Bearing play

3 Bearing shell thickness

4 Console diameter

* See Specifications

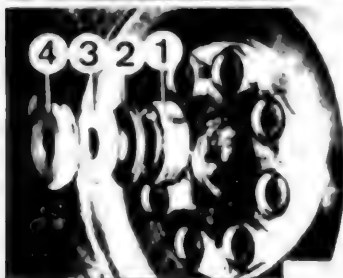
11-110

11 21 571 REPLACING PILOT BEARING IN CRANKSHAFT

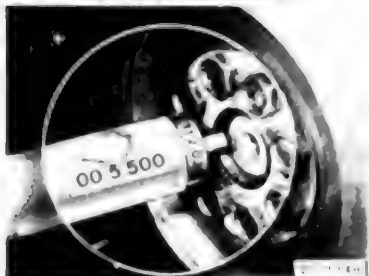
Remove clutch 21 21 000
Pull out ball bearing with Special Tool
11 2 010



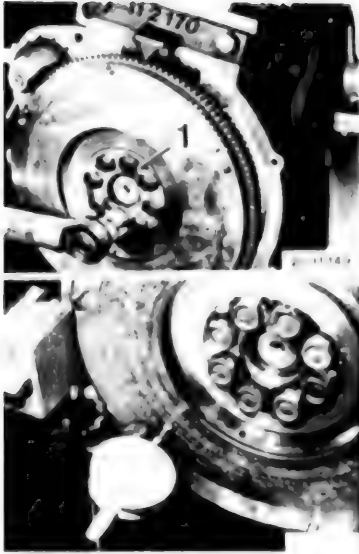
Installed Order
1 Ball bearing
2 Cover
3 Felt ring
4 Capsule
Insert cover (2) with embossment facing out



Pack bore in crankshaft with approx. 1 gram of
lubricating grease
Drive in pilot bearing with Special Tools
11 2 030 and 00 5 500



11-111



11 22 000 REMOVING AND INSTALLING FLYWHEEL

Remove clutch - see 21 21 000
Hold flywheel with Special Tool 11 2 170
Unscrew bolts and take off flywheel

Installation

Clean tapped bores
Insert ring (1)
Install new bolts coated with microencapsulated cement
Tightening torque*

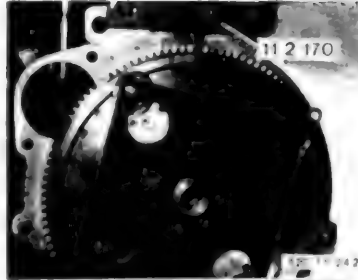
If necessary, check flywheel for axial runout*

The friction surface may be machined to minimum distance A*
If machining the friction surface reduces distance "h" to zero, the flange surface (distance "h") must be machined
Machining is not possible on a double-mass flywheel

68 88 11 072



* See Specifications
** Source of Supply: BMW Parts



11 22 051 REPLACING DRIVE PLATE FOR TORQUE CONVERTER

Remove transmission - see Group 24
Hold flywheel with Special Tool 11 2 170
Unscrew bolts and take off flywheel

Installation

Clean tapped bores
Install new bolts coated with microencapsulated cement
Tightening torque*

11 22 541 REPLACING STARTER GEAR RING

Drill a hole about 8 mm deep below a tooth gap with a 6 mm dia. drill to make breaking the gear ring easier

Break gear ring at drilled point with a chisel

Installation

Heat new starter gear ring to 200 - 230 °C
Check temperature with a thermo color pencil
Tooth bevel faces engine
Mount starter gear ring to fit firmly with help of a brass mandrel

* See Specifications

11-112



11 23 010 REPLACING VIBRATION DAMPER

M 20 B 20 - B 27

Take drive belts off of alternator, power steering pump and, if applicable, compressor for air conditioner

Installation:

Tighten drive belts and check tightness with Special Tool 11 5 020



M 20 B 23 - B 25

Remove fan - see 11 52 000

Take drive belt off of alternator, power steering pump and, if applicable, air conditioner

Unscrew pulley on water pump

Installation:

Tighten drive belt and check tightness with Special Tool 11 5 020

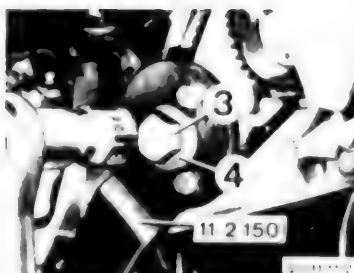


All:

Take pulley and vibration damper off of hub

Installation:

Centering pin must be in bore of vibration damper



11 23 031 REPLACING HUB FOR VIBRATION DAMPER

Two Piece Hub Pulley

Remove radiator 17 11 000

Remove vibration damper 11 23 010

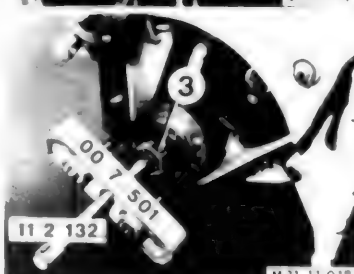
Hold hub with Special Tool 11 2 150

Unscrew bolt (3)

Take off collar (4)

Installation:

Tightening torque*



Screw in bolt (3) about three turns

Pull hub off of crankshaft with Special Tools

00 7 501 and 11 2 132

Unscrew bolt (3).

* See Specifications

11-113

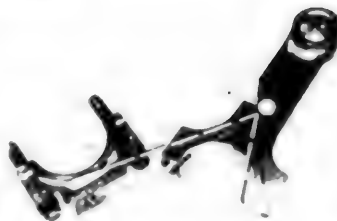


11 24 521 REPLACING CONNECTING RODS RODS Pistons Removed

Important!

Only install connecting rods of same weight class in one engine.
Weight class is stamped in machined surface of conrod bearing cap.
Connecting rods cannot be machined.
Check connecting rod length!

Piston pin must slide through conrod bushing under light pressure



11 24 571 REPLACING CONROD BEARING SHELLS Engine Disassembled

Place conrod bearing shells in connecting rods and conrod caps.

Double Classification

Use red or blue conrod bearing shells according to color code on connecting rod

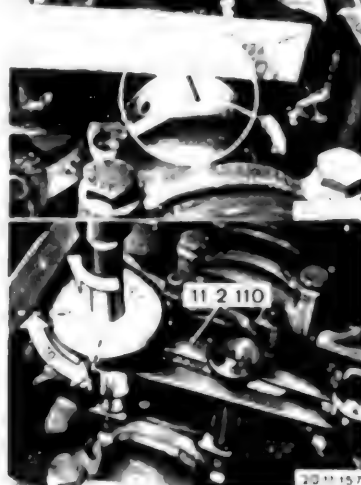
Important!

Check machined size (conrod bearing diameter)



In BDC position place Plastigage Type PG^{*} on crankshaft wiped clean of oil and install conrod bearing caps that all grooves are on one side.
Pairing code (0...99) must be the same on cap and connecting rod.

Source for Plastigage:
Cartool
Alfred Brehm Str. 5
D 8070 Ingolstadt



Tighten bolts in two steps using old conrod bolts!

Step 1 = 20 Nm (14 ft lbs)

Step 2 = 70° torque angle

Important!

Do not turn connecting rods or crankshaft.
Remove bearing caps.

Read bearing play^{*} from supplied scale used to measure width of flattened Plastigage.

Correct bearing play by installing new bearing shells, bearing shells of different machined size or with different color code.

Use new conrod bearing cap bolts for final installation and tighten bolts in two steps (see above).

^{*} See Specifications

11 25 000 REMOVING AND INSTALLING PISTON

Remove engine

Take off cylinder head, oil pan and oil pump.
Unscrew conrod bearing cap and push out piston with connecting rod upwards.

Important!

Mark installed position of connecting rod to crankshaft, if conrod bearings are not being replaced.

Remove circlip (1)

Push out piston pin.

Installation

Piston pins and pistons are matched and must not be mixed up.

Important!

In case of excessive play between piston pin and conrod bush (sounds like acceleration knock), check conrod bush diameter, replacing connecting rod or bush if necessary.

Only install a piston of same make and same weight class.

Weight class is stamped with "1" or "2" in piston crown.

Important!

Check machined size (piston diameter)*.

Engine	Stroke	Piston Bowl Height (mm)	Dia (mm)
M 20 B 20 L	98	33	80
M 20 B 20 L A C S	94	23	80
M 20 B 20 M Z	88	08	80
M 20 B 23 L	98	07	80
M 20 B 23 L A C S	94		80
M 20 B 25 M	97		84
M 20 B 25 M Z	88	44	84
M 20 B 27 M	11	065	84
M 20 B 27 since 9/85	102	09	84
M 20 B 27 M U	9	35 well	84
M 20 B 27 M Z	85	36	84

* See Specifications

**Check piston installed clearance***

Engine	Make	Measuring Point A - mm
M 20 B 20	Mahle	9.00
	KS	25.95
	Alcan	20.50
	Borgo	15.00
M 20 B 23	Mahle	12.00
	KS	18.05
	Alcan	22.70
M 20 B 25 M	Mahle	9.00
	KS	11.65
M 20 B 27	Mahle	23.00
	KS	23.00
M 20 B 27 M Z	Mahle	14.00

Set internal calipers to zero on the micrometer with the measured piston diameter.

Measure cylinder bore at bottom, middle and top with the internal calipers in forward and turning directions.

Compare measured piston installed clearance with specified piston installed clearance / max permissible total wear clearance.

Lubricate piston and piston rings with oil.

Offset piston ring end gaps by 120°.

Compress piston rings with Special Tool 11 2 260.

Install piston that arrow faces toothed belt.
Install connecting rod - see 11 24 521.

* See Specifications

11-115

11 25 651 REPLACING PISTON RINGS OF ONE PISTON - Piston Removed

Measure side clearance* of piston rings

Remove piston rings and measure end
clearance*

Installation

Install piston rings with the word "TOP"
facing the piston crown

- 1 Plain compression ring
- 2 Tapered face compression ring
- 3 Slotted oil scraper ring

Note

It might not be possible to find the identi-
fication on used piston rings.
Lay piston rings aside in correct sequence
and installed position

* See Specifications

11-116

11 31 000 REMOVING AND INSTALLING CAMSHAFT

Remove rocker arm shafts 11 33 020
Unscrew end cover

Check radial oil seal (1) and round cord seal (2), replacing if necessary

Installation

Use Special Tool 11 2 212 for installation of end cover

Check axial play*

Pull out camshaft

Camshaft Codes:

Type	Degrees	Color Ring	Code
M 20 B 20 L	252	yellow	D
M 20 B 20 M Z	260	—	L
M 20 B 23 L	252	white	C
M 20 B 25 M	260	green	F
M 20 B 25 M Z	260	—	K
M 20 B 27 M	236	—	B
M 20 B 27 M	236	blue	G
since 9/85			
M 20 B 27 M U	236	—	B
M 20 B 27 M Z	236	—	B

* See Specifications

11 31 100 TIGHTENING TOOTHED DRIVE BELT

Do not retighten an used toothed drive belt
replace a loose toothed drive belt
Tighten toothed drive belt at coolant temperature of 15 to 35° C (60 to 95° F)

Remove rubber guard (1)

Unscrew nut (2)

Installation

Tightening torque*

Unscrew bolts (3)

Crank engine on crankshaft in running direction of engine

This tightens the toothed belt

Now tighten bolts (3)

Tightening torque*

* See Specifications

11-117

11 31 110 REPLACING TOOTHED BELT

Always replace an used toothed belt each time the tensioning roller is loosened regardless of the mileage ***

Set valves in cylinder no. 1 to TDC (speed governor aligned with notch in distributor housing)

Loosen clamp (1)
Remove bolt (2) and take off suspension eye (3)

Unscrew nut (4)
Lift out TDC sender lead (5)
Remove protective cover (6)
Remove vibration damper - see 11 23 010

Two Piece Hub Toothed Belt Sprocket:
Remove hub for vibration damper - see 11 23 031
Swing away clamp (7)
Lift out TDC sender (8)
Unscrew screw (9) and take off protective cover

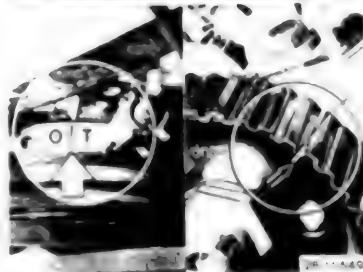
*** See Service Information of Gr. 11



ONE ENGINE:
Unscrew distributor cap (1)
Unscrew distributor rotor (2)
ONE ENGINE:
Unscrew adapter (8)
Remove cover (3)
Unscrew screws (4)
Check seal (9) replacing if necessary
Tightening torque*



Take off rubber guard (5)
Unscrew nut (6)
Remove protective cover (7)
Reinstall adapter (8)



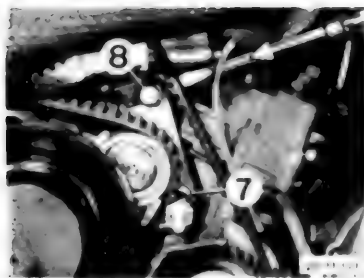
Turn crankshaft to move valves in cylinder no. 1 to TDC (arrow on camshaft sprocket faces mark on cylinder head)
Remove vibration damper - see 11 23 010



Two Piece Hub Toothed Belt Sprocket:
Remove hub for vibration damper - see 11 23 031
Swing away clamp (7)
Lift out TDC sender (8)
Unscrew screw (9) and take off protective cover

* See Specifications

11-118



All
Loosen bolts (7 and 8).
Push in tensioning roller.
Tighten bolt (8).
Take off drive belt.



There are different toothed drive belt versions:
1. Sprockets with Square Profile
A Square profile with 111 teeth
B Square profile with 110 teeth ("Z 127") with modified tensioning spring and tensioning roller marked "Z 127"

2. Sprockets with Semi-round Profile
A Semi-round profile with 128 teeth
B Semi-round profile with 127 teeth ("Z 127") and tensioning roller marked "Z 127"

Versions A must be converted to B***
Install toothed drive belt starting from the crankshaft sprocket and working opposite the engine's direction of rotation.

Check position of the distributor.



Tightening Toothed Drive Belt

Loosen bolt (8) (spring force should be capable of moving the tensioning roller).

Crank engine once on the crankshaft in direction of rotation up to the TDC mark (drive belt is tightened).

Check timing (mark on camshaft sprocket must be aligned precisely with mark on cylinder head with the crankshaft at TDC mark).

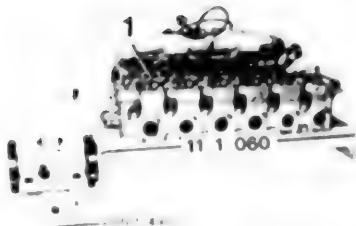
Paste a label containing the date and mileage on the cylinder head cover after finishing the work.



Toothed Drive Belt Assembly
1 Camshaft sprocket
2 Tensioning roller
3 Crankshaft sprocket
4 Intermediate shaft sprocket
5 Toothed drive belt

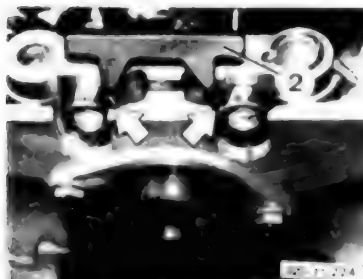
*** See Service Information of Gr. 11

11-119

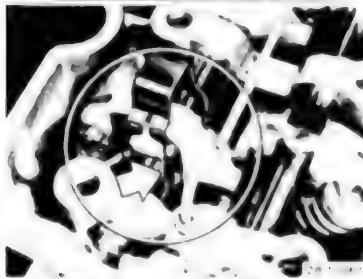


11 33 020 REMOVING AND INSTALLING ROCKER ARM SHAFTS

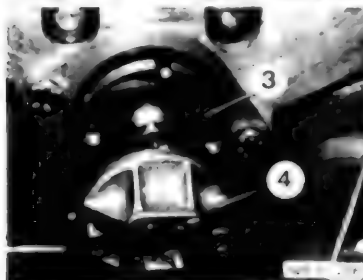
Engine with Distributor
Remove cylinder head 11 12 100
Mount cylinder head on Special Tool
11 1 060 and bolt down with one cylinder
head bolt
Unscrew oil line (1):



Unscrew toothed belt sprocket
Adjust clearance of all valves to maximum
value
Remove plugs
Remove guide plate (2)
Installation:
Guide plate (2) must fit in grooves of rocker
arm shafts



Lift out clamps.
Installation:
Straight surface of clamp must fit in groove of
rocker arm shafts

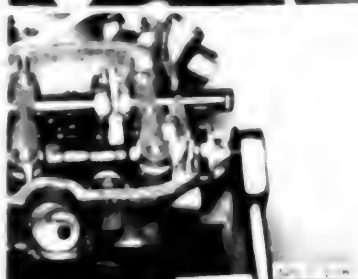


Mount disc (3) and adapter (4) on camshaft to
turn the camshaft

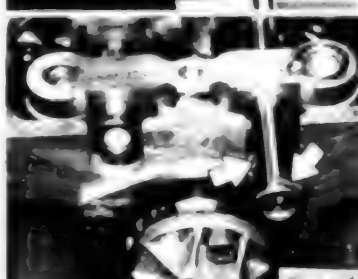


Removing Rocker Arm Shafts

a) Exhaust Side
Valves of cylinder no. 6 must overlap
Push in rocker arm of first cylinder
Turn camshaft on adapter toward intake
side until pressure is taken off of all rocker
arms
Pull out rocker arm shaft or drive out with
Special Tool 11 3 050

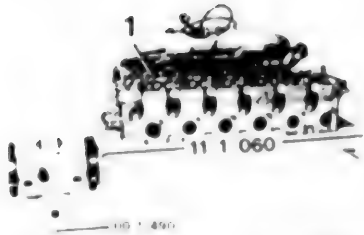


b) Intake Side
Turn camshaft on adapter toward exhaust
side until pressure is taken off of all rocker
arms
Pull out rocker arm shaft or drive out with
Special Tool 11 3 050



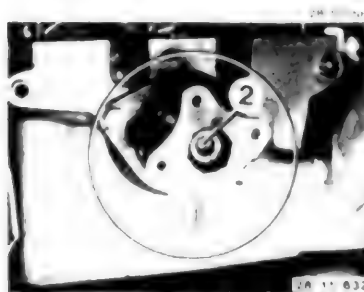
Replace worn rocker arm shafts and rock-
arms
Installation:
Install rocker arm shafts that large oil bores
face valve guides and grooves for guide plate
face in

11-120

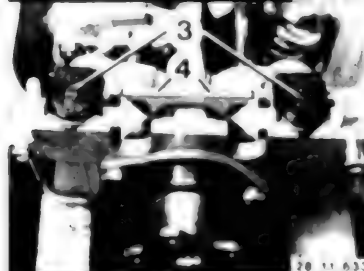


11 33 020 REMOVING AND INSTALLING ROCKER ARM SHAFTS

Engine with DME
Remove cylinder head 11 12 100
Mount Special Tool 11 1 060 on assembly stand
00 1 490 and mount cylinder head with one
cylinder head bolt
Unscrew oil line (1)
Remove toothed belt sprocket



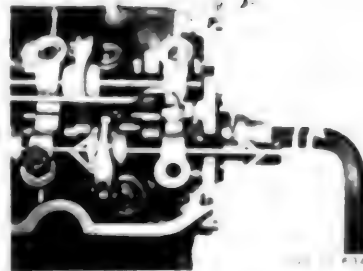
Mount adapter (2)
Adjust valve clearance of all valves to
maximum value



Lift out front and rear plugs (3)
Remove guide plate (4)
Guide plate (4) must fit in grooves of rocker
arm shafts

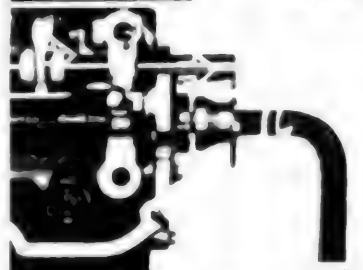


Lift out clamps
Straight surface of clamps must fit in groove
of rocker arm shafts



Removing Rocker Arm Shafts

a) Exhaust Side
Valves of cylinder no. 6 must overlap
Push in rocker arm of first cylinder and
turn camshaft on adapter toward intake
side until pressure is taken off of all
rocker arms
Pull out rocker arm shaft or drive out with
Special Tool 11 3 050



b) Intake Side
Turn camshaft on adapter toward exhaust
side and move rocker arms until pressure is
taken off of all rocker arms
Pull out rocker arm shaft or drive out with
Special Tool 11 3 050



Replace worn rocker arm shafts and rocker
arms

Install rocker arm shafts that oil bores - large
face down toward valve guide and small oil
bores and grooves for guide plate face in

11-121

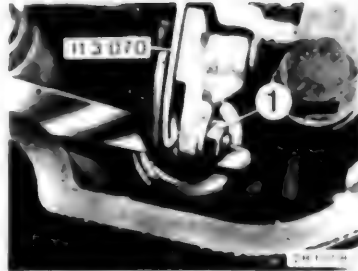
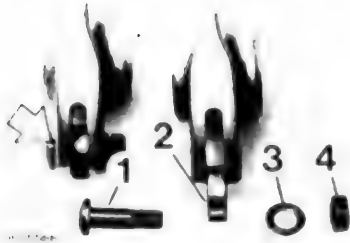
11 33 031 REPLACING ROCKER ARMS

Remove rocker arm shafts 11 33 020
 Replace worn rocker arms or rocker arms with loose slides.
 Loose slides will be noticed as unusually loud valve noise



Transfer adjusting screw (1), eccentric (2), washer (3) and nut (4) to new rocker arm
 Replace a worn eccentric

important
 Adjusting screw and nut have M 6 x 0.75 fine threads
 Bore faces out and thick side down
 Bevelled surface of adjusting screw faces boss on rocker arm

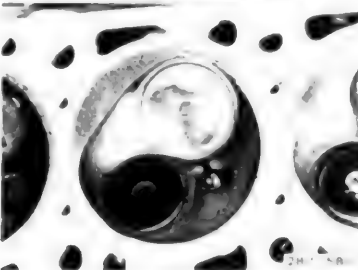


11 34 004 ADJUSTING VALVE CLEARANCE

Remove cylinder head cover 11 12 000
 Crank engine on crankshaft
 Make adjustments in firing order 1 5 3 6 2 4 in compression TDC
 Adjust valve clearance* between valve and eccentric after loosening nut (1)



Tighten nut (1) with Special Tools 11 1 150 and 00 2 050
 Tightening torque*



11 34 509 CHECKING ALL VALVES FOR LEAKS

Camshaft Removed

Spark plugs remain installed
 Fill combustion chamber with gasoline outdoors or indoors in conformance with fire prevention regulations
 Valves and valve seats must be inspected, if gasoline escapes around the valve heads
 Remove and install valves 11 34 550
 Machine valve seats 11 12 607

* See Specifications

11-122

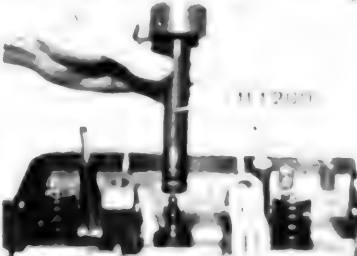
11 34 550 REMOVING AND INSTALLING VALVES

Remove rocker arm shafts 17 33 020
Place Special Tool 11 1 066 (tray) in Special Tool 11 1 060
Unscrew intake manifold
Installation:
Replacing gaskets

Press down valve springs with Special Tool 11 1 060 and remove valve collets

Take off upper spring retainer, valve springs and lower spring retainer
Take tray out of assembly fixture and pull out valves
Installation:
Only install valve springs with same color code, wire gage size and length
Lubricate valve guides and valve stems with oil

Pull off valve seal with Special Tool 11 1 250



Install valve
Always use Special Tool 11 1 350 to avoid damaging valve seals
Lubricate valve seal (1) with oil and install
Source for Special Tool Sleeves
Cartool
Alfred Brehm Str
D 8070 Ingolstadt

With "Gotze" Seals
Press on valve seal to fit tight with Special Tool 11 1 140
Dia. A = 12.8 mm (0.504")
With "Eirring" Seals
Press on valve seal to fit tight with Special Tool 11 1 080
Dia. A = 13.5 mm (0.531")

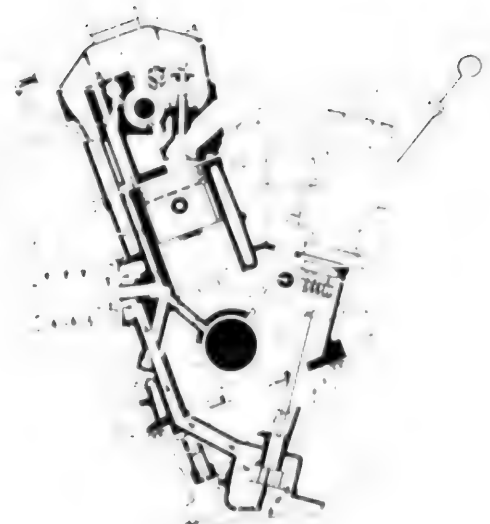
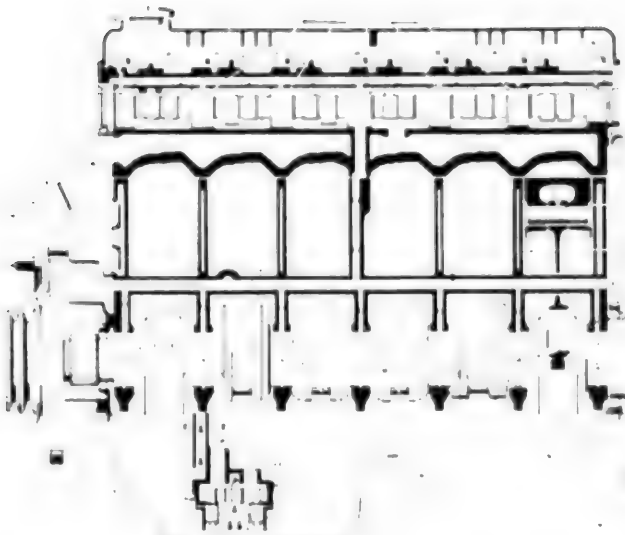
New, improved valve stem seals with grooves on the inside are pressed on by hand with Special Tool 11 1 200
Special Tool 11 1 200 has two diameters for 7 mm (0.276") and 8 mm (0.315") valve stem seals

11 35 020 REMOVING AND INSTALLING DISTRIBUTOR INTERMEDIATE SHAFT

Remove fuel pump - see 13 31 030
Remove distributor - see 12 11 060
Remove front end cover - see 11 14 175
Unscrew guide (1) and pull out intermediate shaft (2)

Installation:
Check sprocket, replacing interm. shaft if necessary. Install sprocket with mark "B"***
Bearings in crankcase cannot be replaced
*** See Service Information of Gr 11

11-123



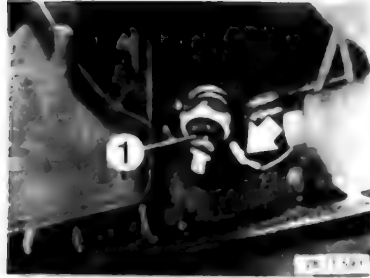
520 11 253

Oil pressure
Oil temperature

ENGINE OIL CIRCUIT

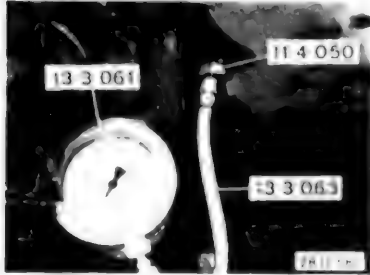
- | | | | |
|--|---------------------------------|------------------------------------|--------------------|
| 1 Oil pan | 5 Main distribution bore | 14 Rocker arm bearings (exhaust) | 22 Oil drain |
| 2 Intake with filter screen | 6 Oil pressure lamp sensor | 15 Intermediate shaft bearings | 23 Oil filler neck |
| 3 Oil pump | 7 Crankshaft bearing | 15a Spray oil for distributor gear | 24 Oil dipstick |
| 3a Safety valve | 8 Oil bore in cylinder head | 16 Oil line for cams | 25 Oil drain plug |
| 4 Oil filter | 9 Hollow rocker arm shaft | 17 Valve guide | |
| 4a Safety valve (oil filter) | 10 Front camshaft bearing | 18 Conrod bearing | |
| 4b Check valve, unfiltered side) prevent draining of filter | 11 Camshaft bearing | 19 Spray oil | |
| 4c Check valve, filtered side) on stopped engine | 12 Rear camshaft bearing | 20 Piston pin cylinder wall | |
| 4d Pressure relief valve | 13 Rocker arm bearings (intake) | 21 Spill from cylinder head | |

11-124



11 40 000 CHECKING ENGINE OIL PRESSURE

Pull off wires on oil pressure switch
 Unscrew oil pressure switch (1)
Installation
 Check gasket, replacing if necessary



Screw in Special Tool 11 4 050 (connector)
 Connect Special Tool 13 3 063 (hose) in conjunction with Special Tool 13 3 061 (pressure tester)
 Check oil pressure*

* See Specifications

11-125

11 41 000 REMOVING AND INSTALLING OIL PUMP

Remove oil pan 11 13 000
Unscrew oil pump

Installation

Guide in drive shaft (1)
Replace bearing - see 11 11 160 325 iX.
Fill master oil bore (pressure end) of oil pump with engine oil***

Testing and Servicing

Unscrew cover (2) and clean oil filter screen (3)

Check whether gears turn easily by turning the drive shaft

Unscrew oil pump cover and check oil pump for wear

Scoring in body - cover
Wear on gears

The pressure relief valve regulates oil pressure in front of the oil filter and prevents oil filter leakage

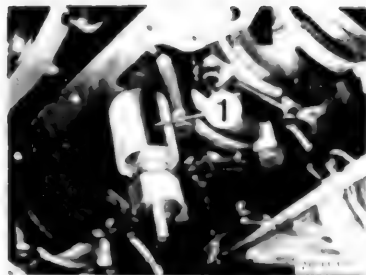
Check that piston (5) moves easily
Check length of spring (6) : 44 ± 0.2 mm
(1.732 ± 0.008")

Installation

Press in and hold spring (6) and washer (7) with a screwdriver
Install circlip (8)

*** See Service Information of Gr. 11

11-126



11 41 110 REMOVING AND INSTALLING PRESSURE RELIEF VALVE

The pressure relief valve is located in the main bore and regulates the engine oil pressure* after the oil filter.
Remove oil pan 11 13 000
Unscrew pressure relief valve
Remove sleeve (1)



11 42 020 REPLACING FULL FLOW OIL FILTER

Unscrew filter with Special Tool 11 4 020
Installation:
Give gasket a light coat of oil
Screw on oil filter by hand until gasket makes contact and then tighten by hand with one half turn.
Add oil, start engine, check oil level and check for leaks.
If oil pressure is not built up in engines after replacing the oil filter cartridge, stop engine, turn (loosen) filter about 90°, start engine again and tighten filter after oil runs out at filter briefly (bleeding procedures)



11 43 101 REPLACING GUIDE TUBE FOR OIL DIPSTICK

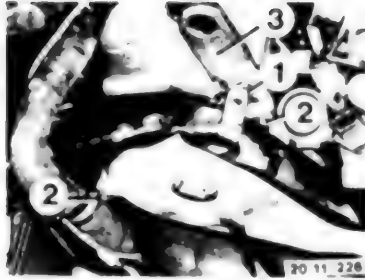
Install guide tube with Loctite No. 270** and drive in against stop



* See Specifications

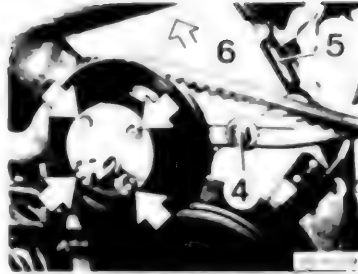
** Source: HWB

11-127



11 51 000 REMOVING AND INSTALLING WATER PUMP

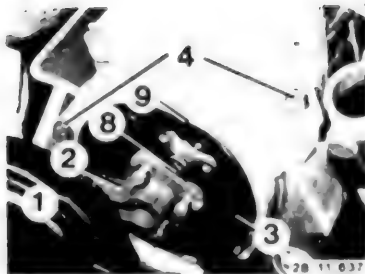
Engine with Distributor
 Drain coolant
 Loosen clamp (1)
 Remove bolts (2) and take off suspension eye (3)
 Remove fan 11 52 000
Installation:
 Fill and bleed cooling system 17 00 039



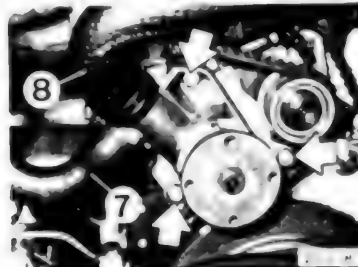
Unscrew pulley
 Unscrew bolt (4) and take off drive belt
 Remove rubber part (5) and pull out cover (6)
Installation:
 Tighten drive belt and check tightness with Special Tool 11 5 020



Compress spring clip and hold pin with Special Tool 11 5 010
Installation:
 Check installed position of pin to water pump

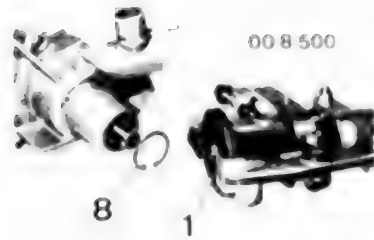


Engine with DME
 Drain coolant
 Remove distributor cap (1)
 Remove distributor rotor (2)
 Unscrew adapter (8)
 Remove cover (3)
 Unscrew bolts (4)
 Remove fan 11 52 000
Installation:
 Fill and bleed cooling system 17 00 039
 Check seal (9), replacing if necessary



Disconnect water hoses (7 and 8)
 Unscrew water pump
Installation:
 Replace gasket

11-128



00 8 500

11 51 502 OVERHAULING WATER PUMP WATER PUMP REMOVED -

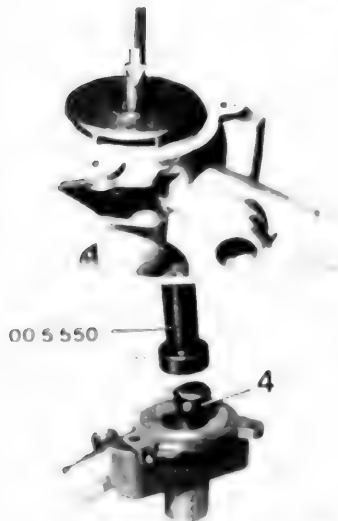
Pull off hub (1) with Special Tool 00 8 500
Remove circlip (8)



Replace bearing (3) and seal (4)
Check impeller (6) replacing if necessary
1 - Hub
2 - Water pump body
Installation
Press in bearing (3) against stop
Press on impeller (6)

Press out water pump bearing

Check assembled distances

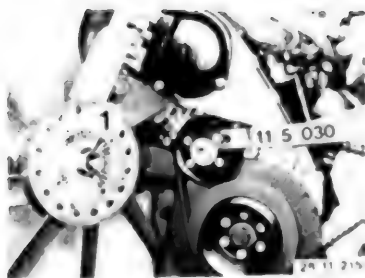


00 5 550

Drive out seal (4)

Installation
Press in seal (4) with Special Tool 00 5 550

11-129



11 52 000 REMOVING AND INSTALLING FAN

Temperature Dependent Viscous Fan Clutch
Hold pulley with Special Tool 11 5 030 and unscrew coupling nut (1)

Important!

Left hand threads — loosen nut by turning clockwise
Tightening torque*

Installation

Tighten fan with Special Tool 11 5 040
40 Nm (29 ft. lbs.) tightening torque is equal to 30 Nm (22 ft. lbs.) setting on torque wrench.



30 40 100

11 52 020 REPLACING FAN CLUTCH

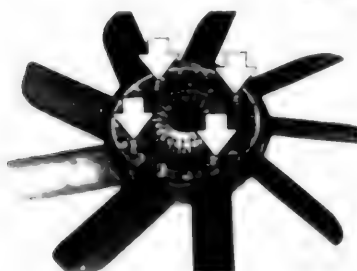
Remove fan — see 11 52 000.

Fan clutch must be replaced when

- a) hub has seized — fan of stopped engine cannot be turned or is hard to turn.
- b) fan clutch has axial and/or radial play or is losing oil.

Check switching points* with a Vibrocard***

Unscrew fan mounting bolts and take off fan clutch.



11 53 000 REMOVING AND INSTALLING COOLANT THERMOSTAT

Drain coolant partially
Take off cover (1)

Installation:

Bleed cooling system — see 17 00 039

Remove thermostat

Installation:

Clamp on thermostat faces out

Replace rubber ring (2)

New Thermostat Housing Since 1986 Models
Install thermostat with number 1 715 040 (small valve seat)

Checking Thermostat

Does thermostat begin to open at temperature given in the Specifications?

Check opening temperature by placing thermostat in hot water and compare test value with specified value

11 53 080 REPLACING TEMPERATURE TRANSMITTER

Pull off wire (1)

Unscrew transmitter

Installation:

Replace seal (2)

Bleed cooling system — see 17 00 039

* See Specifications

*** See Workshop Equipment Catalog

11 Engine M21

11 12 000	Cylinder head cover – remove and install	11- 201
101	Cylinder head gasket – replace	11- 202
240	Radial oil seal in end cover – replace	11- 203
500	Cylinder head – remove and install (engine removed)	11- 204
595	Valve guide – check for wear (valve removed)	11- 205
600	Valve guide – ream (valve removed)	11- 205
607	Valve seat – machine (cylinder head disassembled)	11- 205
729	Cylinder head – check for cracks in water test (cylinder head disassembled)	11- 206
11 14 175	Front end cover – remove and install	11- 207
180	Radial oil seal in front end cover – replace	11- 207
605	Radial oil seal in clutch end cover – replace	11- 208
11 21 000	Crankshaft – remove and install	11- 209
501	Crankshaft – replace (crankshaft removed)	11- 210
531	Crankshaft main bearing shells – replace (engine disassembled)	11- 210
571	Pilot bearing in crankshaft – replace	11- 211
11 22 000	Flywheel – remove and install	11- 211
051	Drive plate for torque converter – replace	11- 211
11 23 010	Vibration damper – replace	11- 212
031	Vibration damper hub – replace	11- 212
11 24 521	Connecting rods – replace (pistons removed)	11- 213
571	Connecting rod bearing shells – replace (engine disassembled)	11- 213
11 25 000	Piston – remove and install	11- 214
651	Piston rings of one piston – replace (piston removed)	11- 215
11 31 000	Camshaft – remove and install	11- 216
100	Drive belt – tighten	11- 217
110	Drive belt – remove and install	11- 218
11 33 050	Rocker arms – replace	11- 219
11 34 004	Valve clearance – adjust	11- 219
509	Valves – check for leaks (camshaft removed)	11- 219
550	Valves – remove and install	11- 220
11 35 020	Intermediate shaft – remove and install	11- 220
	Engine oil circuit	11- 221
11 40 000	Engine oil pressure – check	11- 222
11 41 000	Oil pump – remove and install	11- 223
11 42 020	Full flow oil filter – replace	11- 224
650	Oil spray jet – remove and install/replace (crankshaft removed)	11- 224
11 51 000	Water pump – remove and install	11- 224
502	Water pump – overhaul (water pump removed)	11- 225
11 52 000	Fan – remove and install	11- 226
020	Fan clutch – replace	11- 226
11 53 000	Coolant thermostat – remove and install	11- 226
080	Temperature transmitter – replace	11- 226

11-200

- | | |
|------|------------------------|
| M 21 | - Small 6 cylinder |
| D | - Diesel |
| 24 | - Displacement (x 100) |
| W | - Swirl chamber |

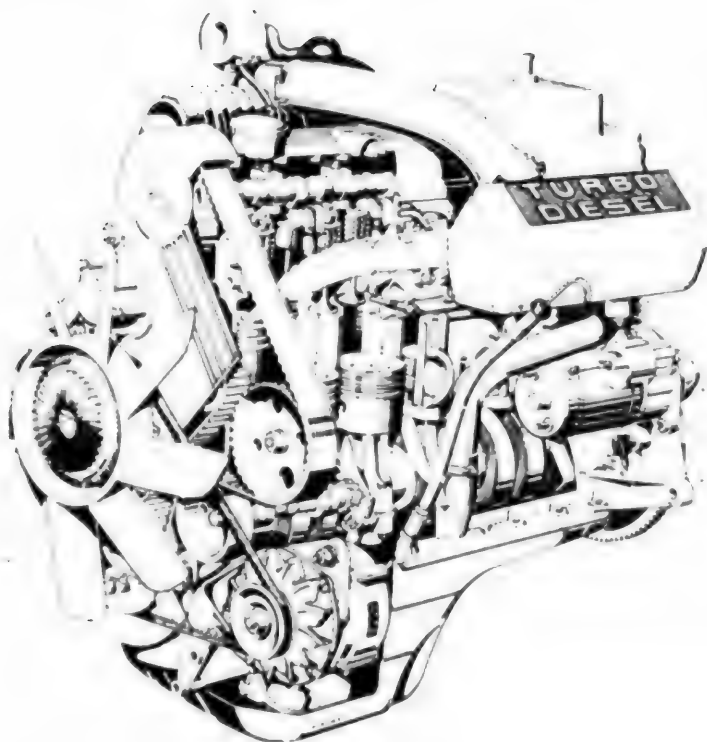


M 21 D 24 W BMW 324 d · 524 d

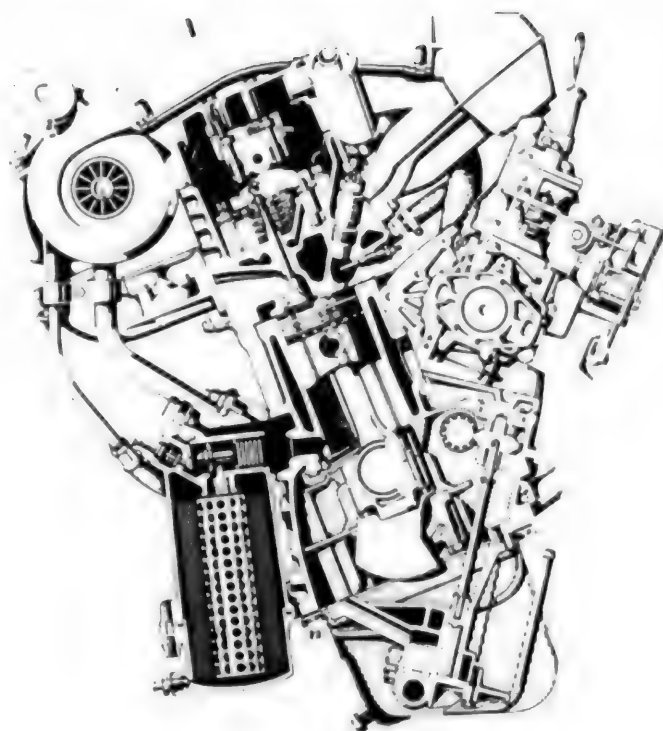


11-200a

M 21	Small 6 cylinder
D	Diesel
24	Displacement (x 100)
W	Swirl chamber
A	Turbocharged



M 21 D 24 W A BMW 524td



11- 200b

WORKING INSTRUCTIONS

concerning cleanliness on fuel system

Clean area around repair point thoroughly – e.g. prior to unscrewing lines, switches, etc.

Always place removed parts on a clean surface and cover with plastic sheet – never use rags losing lint!

Close off or insert plugs in open lines and components immediately

Only install cleaned parts

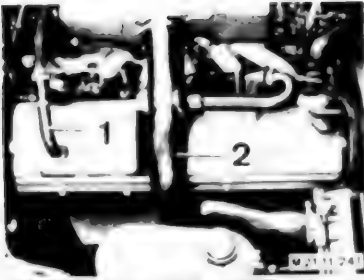
Take new spare parts out of their packaging only immediately before installation

Never let diesel fuel spill on to coolant hoses – if applicable, wash off immediately with water

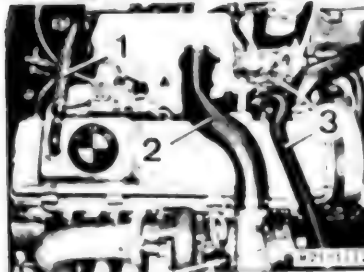
11-201

11 12 000 REMOVING AND INSTALLING CYLINDER HEAD COVER

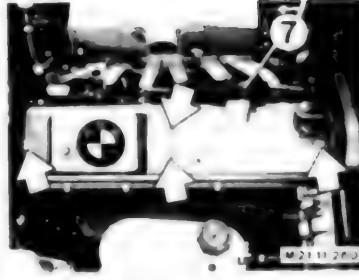
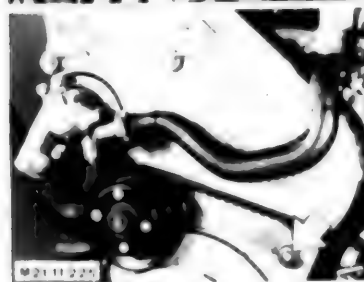
M 21 D 24 W
Disconnect hoses (1 - 2)



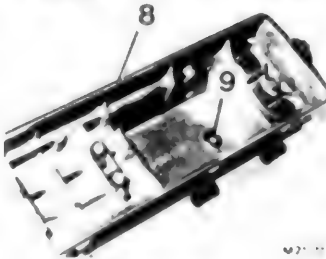
M 21 D 24 WA
Disconnect hoses (1 - 3)



Loosen screws of cover
Installation
First tighten the cylinder head cover and
then the protective cover



Remove oil trap (7)
Unscrew threaded sleeves and take off cylinder
head cover
Installation
Install threaded sleeves with seals
Check seal on oil trap, replacing if necessary



Installation
Check cylinder head cover gasket (8) and
rubber ring (9), replacing if necessary
Insert rubber ring (9) in cover and lubricate
with oil
Tightening torque*

* See Specifications

11-202

11 12 101 REPLACING CYLINDER HEAD GASKET

Remove cylinder head 11 12 100.
Clean sealing surfaces on cylinder head and crankcase carefully with gasket remover** and a hard wood scraper (even slight scratching would cause engine to leak because of high compression).

Check levelness with standard steel ruler.
Never machine cylinder heads.

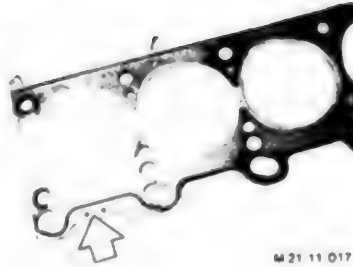
Install a cylinder head gasket conforming with highest piston protrusion of all six pistons.

Measuring Piston Protrusion
Place dial gauge in Special Tool 00 2 530 on cleaned cylinder head sealing surface and set to zero with pre-load.

Apply dial gauge on measuring point "A" of cleaned piston and find highest point by turning crankshaft.

Note displayed value -- piston protrusion "A".
Apply dial gauge on measuring point "B" and note piston protrusion "B".

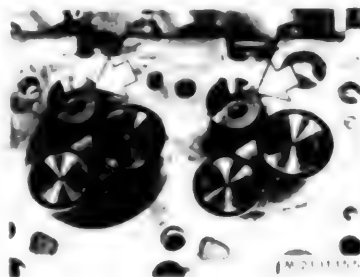
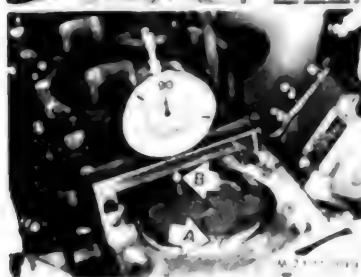
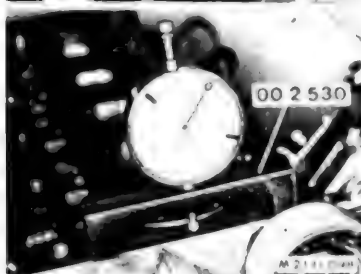
Mean value of "A" + "B" is the "piston protrusion" of a piston.
Repeat measuring on all six pistons.



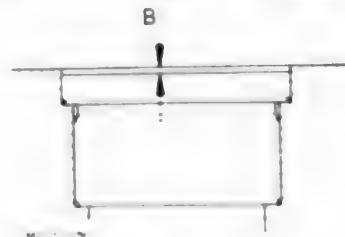
M 21 11 017

Piston with highest "piston protrusion" will determine thickness of cylinder head gasket.
Cylinder Head Gaskets

Highest Piston Protrusion of All 6 Pistons (mm)	Code of Cylinder Head Gasket (no. of holes)
0.64 0.78	1
0.79 0.91	2
0.92 1.08	3



Burners are installed with shrink fit in cylinder head.
Replace cylinder head, if burners are loose or damaged.



Burner protrusion = distance "B"

* See Specifications

11-203

11 12 240 REPLACING RADIAL OIL SEAL IN END COVER

Remove toothed drive belt 11 31 110
Unscrew pulley (1)
Instructions:
Slide slot of pulley and bore of washer (2)
over pin of camshaft

Unscrew oil line (3) and take off bearing cap
(4)
Pull off radial oil seal

Coat sealing surface with a brush on universal
sealing compound Three Bond Silicon
1207** and mount bearing cap (4)
Tightening torque*

Push on radial oil seal over Special Tool
11 2 212
Lubricate sealing lip with oil

Press in radial oil seal with Special Tools
11 3 080 and 00 5 500
Press in new radial oil seal against stop in
contradiction to the standard seal which was
installed flush

* See Specifications
** Source: HWB

11-204

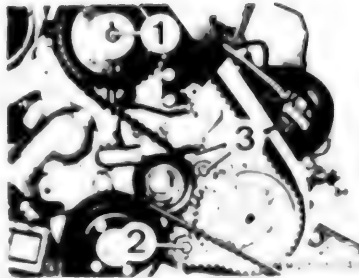
11 12 500 REMOVING AND INSTALLING CYLINDER HEAD - Engine Removed -

Unscrew injection pipes on fuel injectors and injection pump with Special Tool 13 5 020
Mount protective caps
Remove cylinder head cover - see 11 12 000
Installation:
Tightening torque: 20 to 25 Nm (15 to 18 ft. lbs.)

Turn cylinder no. 1 to TDC - cylinder no. 6 overlaps

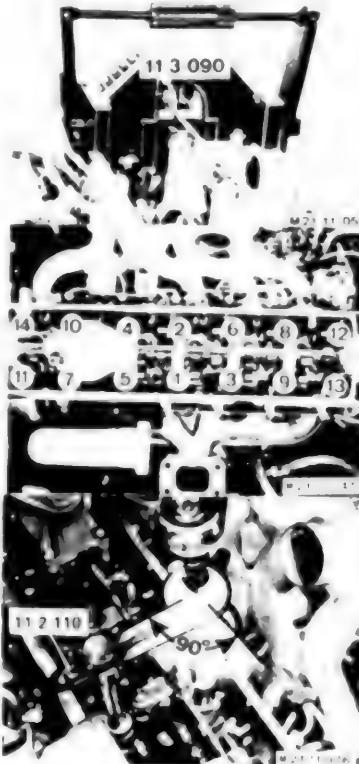
Hold crankshaft with Special Tool 11 2 300

Remove hose (5) and protective cover
Installation:
Tighten the cylinder head cover first and then the protective cover



Loosen bolts (1 and 2) and nut (3)
Loosen and take toothed drive belt off of the camshaft sprocket

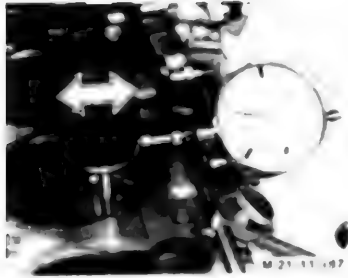
Installation:
Turn in the camshaft before mounting the cylinder head, so that valves of cylinder no. 6 overlap - hold camshaft with Special Tool 11 3 090
Install and tighten toothed drive belt - see 11 31 110



Unscrew bolts in order of 14 - 1 and take off the cylinder head
Installation:
Keep oil out of cavities since otherwise bolts tightened with specified torque might not exert sufficient force on the cylinder head
In addition, the crankcase might be cracked
Clean cylinder head bolts
Lubricate threads and bearing surfaces of bolt heads with a light coat of oil
Replace cylinder head gasket - measure piston protrusion - see 11 12 101
Tighten bolts in order of 1 - 14 in three steps*
Adjust valve clearance - see 11 34 004
Check static adjustment of the injection pump - see 13 51 005
Tighten cylinder head bolts to specified torque angle with Special Tool 11 2 110 regardless of the engine temperature in the 3rd step (cover of cylinder head removed again after running engine warm)

* See Specifications

11-205



11 12 595 CHECKING VALVE GUIDE FOR WEAR

- Valve Removed

To check install a new valve that the end of the valve stem is flush with the valve guide. Apply dial gauge and measure tilt play. Max. permissible tilt play*



11 12 607 MACHINING VALVE SEAT

- Cylinder Head Disassembled

The valve seat machine from Hunger and a five sided cutting tool from New Way must be used to machine valve seat insert rings. An oversize valve must be installed after machining a valve seat. Machine valve seat insert rings until specified valve retraction "R" is reached.



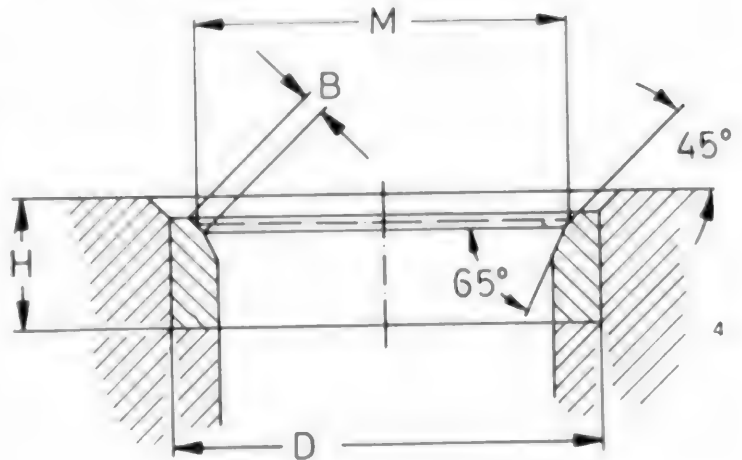
Valve retraction R*
Machine correction angles* to produce valve seat diameter M* and valve seat width B*, after machining the valve seat angle*
Valves may not be ground in.
Check valves for leaks 11 34 509



11 12 600 REAMING OUT VALVE GUIDE

Valve Removed

If there is excessive play between the valve guide and valve stem (see 11 12 595), ream out valve guide and install a repair valve with an oversized stem diameter "S".*
This also requires machining the valve seat see 11 12 607.
Press guide pad (1) on to valve seat and ream out valve guide starting from the combustion chamber end - turn down reamer once.



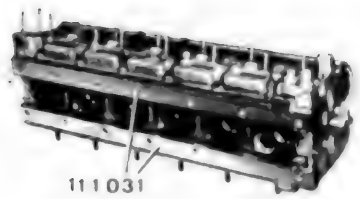
* See Specifications

* See Specifications

11-206

11 12 720 CHECKING CYLINDER HEAD FOR CRACKS IN WATER TEST - Cylinder Head Disassembled -

Mount Special Tools 11 1 031 on cylinder head
(using cylinder head bolts)

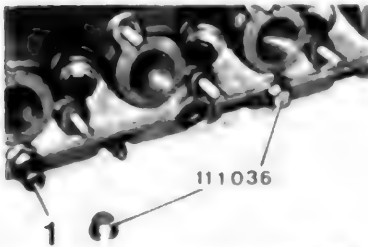


Unscrew adapter (1) and plug openings with
Special Tools 11 1 036

Insert seals

Installation

Install adapter with bolt cement**



Apply Special Tools 11 1 034 and 11 1 035



Attach Special Tool 11 1 033

Apply compressed air on cylinder head

Test pressure = 4.5 bar (64 psi)

Place cylinder head in water bath and check
for leaks

Note

Relax water bath with a detergent if necessary



** Source: HWB

11-207

11 14 175 REMOVING AND INSTALLING FRONT END COVER

Remove vibration damper hub 11 23 031
Remove toothed belt 11 31 110
Hold intermediate shaft gear with Special Tool 11 2 040
Unscrew bolt
Remove washer and gear
Installation:
Guide centering pin into bore

Screw in bolt (1) again
Pull gear off of crankshaft with Special Tools 00 7 501 and 11 2 131
Important!
Woodruff key
Installation:
Mount gear that shouldered end faces forward

Unscrew bolts (4 - 6)
Only loosen other oil pan bolts
Separate oil pan gasket on end cover carefully with a knife
Take off end cover

Installation:
If oil pan gasket is damaged, remove oil pan and replace gasket 11 13 000
Fill bores of oil pan gasket with a brush on universal sealing compound Three Bond Silicon 1207**
Replace gasket (7)

Check radial oil seals, replacing if necessary
Use Special Tool 11 2 211 on crankshaft and Special Tool 11 2 212 on intermediate shaft when installing end cover

11 14 180 REPLACING RADIAL OIL SEAL IN FRONT END COVER

Remove front end cover 11 14 175
Press radial oil seals out of cover
Press in radial oil seals with Special Tools 24 1 050 and 24 1 040
Press in new radial oil seals to depth of approx. 1 to 2 mm (0.039 to 0.079 ") in contradiction to standard seals which were installed flush
Lubricate sealing lips with oil

** Source: H/WB

11-208

11 14 605 REPLACING RADIAL OIL SEAL IN CLUTCH END COVER Transmission Removed

Remove flywheel 11 22 000
Unscrew oil pan/end cover mounting bolts
Only loosen other oil pan bolts
Separate oil pan gasket on end cover carefully
with a knife
Take off end cover
If oil pan gasket is damaged, remove oil pan
and replace gasket 11 13 000

Installation:

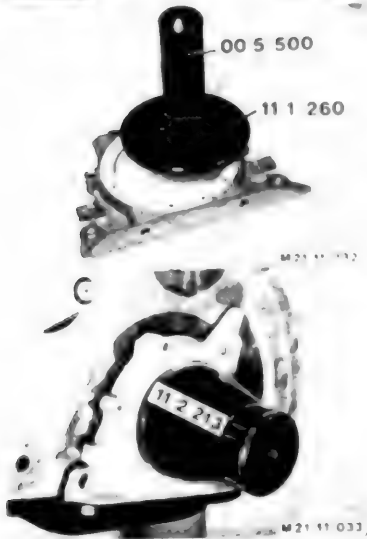
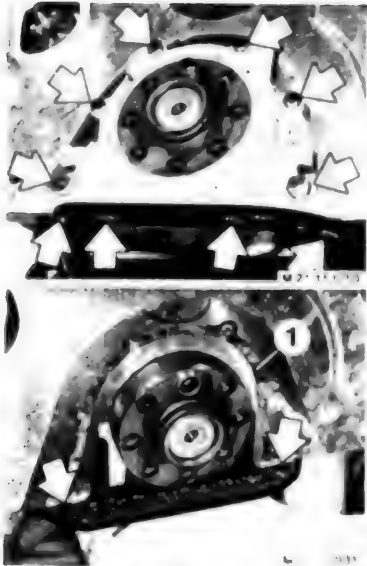
Replace gasket (1)
Coat holes of oil pan gasket with a brush on
universal sealing compound Three-Bond
Silicon 1207**

Press in radial oil seal with Special Tools
11 1 260 and 00 5 500
Press in new radial oil seal to depth of approx.
1 to 2 mm (0 039 to 0 079) in contradiction
to standard seal which was installed flush
Lubricate sealing lip with oil

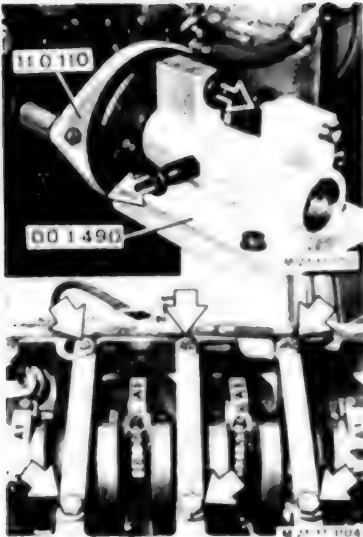
Installation:

Use Special Tool 11 2 213 to install end cover

** Source: MWB



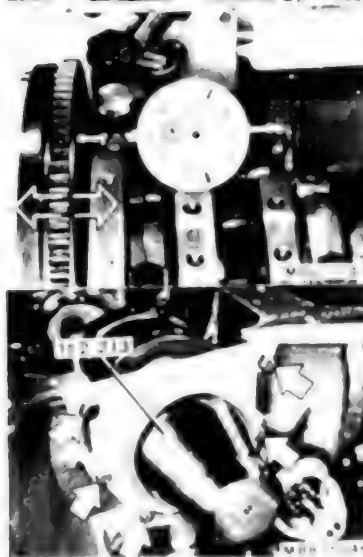
11-209



11 21 000 REMOVING AND INSTALLING CRANKSHAFT

Remove engine 11 00 050
Mount crankcase on Special Tool 00 1490
with Special Tool 11 0 110

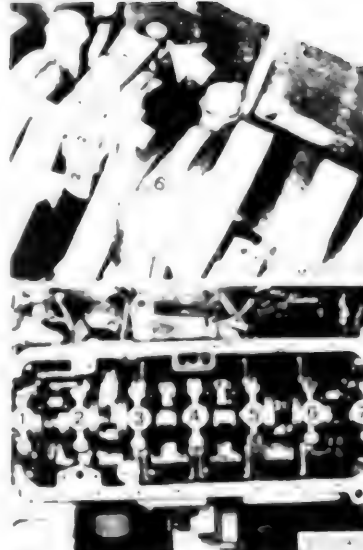
Remove clutch 21 21 000
Remove cylinder head 11 12 100
Remove front end cover 11 14 175
Remove oil pump 11 41 000
Unscrew braces



Check axial play* before removing crankshaft
If maximum permissible play is exceeded
check or replace thrust bearing

Remove flywheel 11 22 000
Take off end cover
Installation
Replace gasket
Use Special Tool 11 2 213 to avoid damaging
radial oil seal
Cut off gasket on oil pan sealing surface

* See Specifications



Unscrew connecting rod bearing caps

Installation

Replace conrod bearing shells and check conrod
bearing play see 11 24 571
Pair code numbers (0 99) must be same on
connecting rods and bearing caps

Remove crankshaft bearing caps and lift out
crankshaft

Installation

Do not mix up bearing caps
Bearing cap no. 1 is on toothed belt end
Bearing cap no. 6 is the thrust bearing
Install bearing shells and check bearing play
see 11 21 531

Check axial play after installing crankshaft
unscrew thrust bearing cap no. 6 again

Center thrust bearing by applying knocks from
a plastic hammer on rear and front ends of
the crankshaft

Tighten thrust bearing cap bolts again as specified
Check axial play*

If crankcase is replaced, clean oil and water
ports again thoroughly to remove casting sand

* See Specifications

11-210

11 21 501 REPLACING CRANKSHAFT - Crankshaft Removed -

Note:

A replacement crankshaft is supplied complete with corresponding bearing shells for main and conrod bearings.

Crankshaft Identification

Engine	Stroke	Code
M 21 D	81.0 mm	C

Crankshaft is surface treated and may only be reground in the factory.

Reground crankshafts are marked with stripes of paint.

Conrod Bearing Journal (A)	
1 paint stripe	Size 1 *
2 paint stripes	Size 2 *

Main Bearing Journals (B)	
1 paint stripe	Size 1 *
2 paint stripes	Size 2 *

Cars with Manual Transmission
Install pilot bearing for transmission main shaft.

Installed Order
Ball bearing (1), cover (2), felt ring (3) and capsule (4)

Insert cover (2) with the embossment facing out.

Fill bore in crankshaft with approx. 1 gram (0.035 oz.) of lubricating grease.
Drive in pilot bearing with Special Tools 11 2 030 and 00 5 500.

* See Specifications

The crankshaft is marked with yellow, green or white paint depending on main bearing journal tolerances.

The bearing shells are marked with yellow, green or white paint.

- 1 Bearing shell 1-2-3-4-5-7
- 2 Bearing shell 6 (pilot bearing)
- 3 Bearing shell with lubricating groove installed in crankcase
- 4 Bearing shell without lubricating groove installed in bearing cap

Check ground size of the main bearing journals!

Installing Instructions

Install only bearing shells with "yellow" color code in the crankcase (regardless of old color code mark on the crankcase).

Install bearing shells with "yellow", "green", "white" color code in bearing caps depending on the crankshaft bearing journal color code.

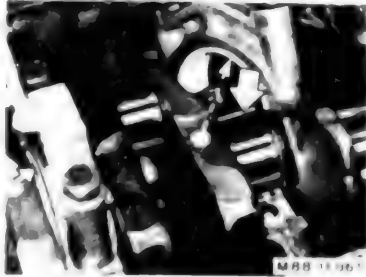
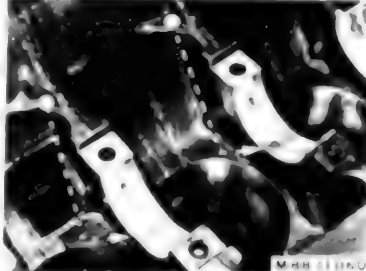
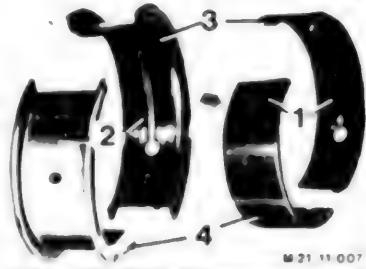
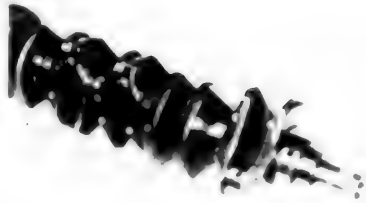
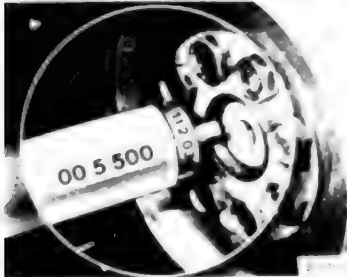
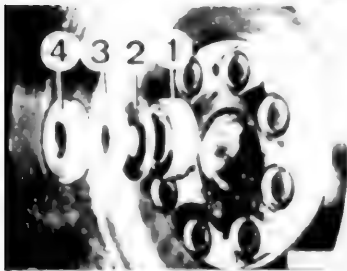
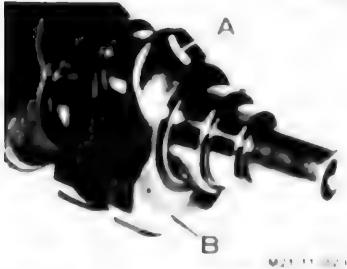
Install crankshaft.

Place Type PG-1 Plastigage on crankshaft wiped clean of oil and tighten bearing caps with the correct torque! Do not turn the crankshaft.

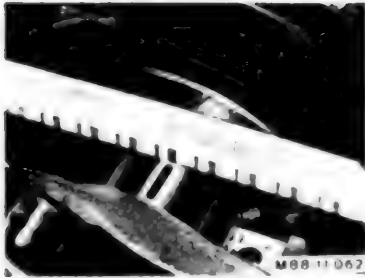
Source of Supply for Plastigage

CARTOOL
Alfred-Brehm-Str. 5
D-8070 Ingoisdorf

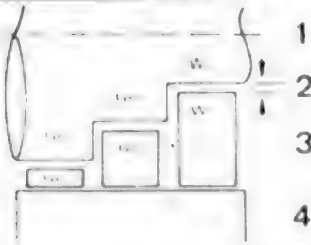
* See Specifications



11-210a



M 88 11 062



Remove bearing caps.
Read bearing play* by measuring the width of the flattened Plastigage with help of the supplied scale.
Correct the bearing play by installing new bearing shells, bearing shells of a different machined size or with a different color code.

Survey of Color Code Shaft Diameter Bearing Shell Thickness*

Triple Classification Color Codes:
Ge = yellow
Gn = green
Ws = white

- 1 Crankshaft diameter
- 2 Bearing play
- 3 Bearing shell thickness
- 4 Console diameter

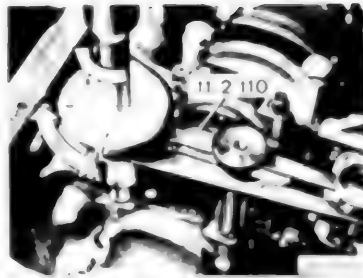
Replacing Conrod Bearing Shells.
Red or blue conrod bearing shells in accordance with the color code mark on the connecting rod are installed standard for a pertinent ground size or crankshaft.

Install only red bearing shells of a pertinent ground size for a replacement crankshaft.

Place Type PG-1 Plastigage on crankshaft wiped clean of oil in the BDC position and mount conrod bearing caps that all grooves are on one side. Pair numbers (0 ... 99) must be the same on caps and connecting rods.

Source of Supply for Plastigage
CARTOOL
Alfred-Brehm-Str. 5
D-8070 Ingolstadt

* See Specifications



Tighten bolts in two steps (use old conrod bolts).

- Step 1 20 Nm (14.5 ft lbs)
- Step 2 70° torque angle

Important:

Do not turn the connecting rods or crankshaft.

Remove bearing caps.

Read bearing play* by measuring the width of the flattened Plastigage with help of the supplied scale.
Correct the bearing play by installing new bearing shells, bearing shells of a different machined size or with a different color code.

Replace conrod bolts for final installation and tighten the conrod bearing caps in two steps (see above).

* See Specifications

11-210b

11 21 531 REPLACING CRANKSHAFT MAIN BEARING SHELLS - Engine Disassembled -

The crankshaft is marked with yellow, green or white paint depending on main bearing journal tolerances

The bearing shells are marked with yellow, green or white paint

- 1 Bearing shell 1-2-3-4-5-7
- 2 Bearing shell 6 (pilot bearing)
- 3 Bearing shell with lubricating groove installed in crankcase*
- 4 Bearing shell without lubricating groove installed in bearing cap

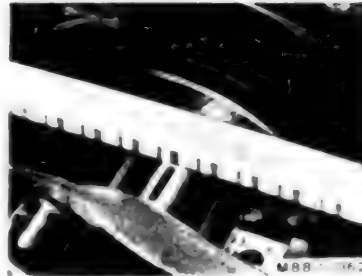
Check ground size of the main bearing journals!

Install bearing shells in the crankcase with the same color code as the dot of paint on the console.
Install both bearing shells according to the crankshaft color code mark. If the color code marked on the crankcase is washed off.
Install bearing shells in the bearing caps with the same color code as for the crankshaft.

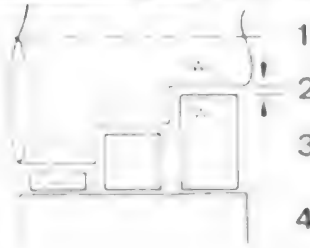
Install crankshaft.
Place Type PG-1 Plastigage on crankshaft wiped clean of oil and tighten the bearing caps with the correct torque*
Do not turn the crankshaft.

Source of Supply for Plastigage
CARTOOL
Alfred-Brehm-Str. 5
D-8070 Ingoistadt

* See Specifications



Remove bearing caps.
Read bearing play* by measuring the width of the flattened Plastigage with help of the supplied scale.
Correct the bearing play by installing new bearing shells, bearing shells of a different machined size or with a different color code.



Survey of Color Code Shaft Diameter
Bearing Shell Thickness*

Triple Classification Color Codes
Ge = yellow
Gn = green
Ws = white

- 1 Crankshaft diameter
- 2 Bearing play
- 3 Bearing shell thickness
- 4 Console diameter

* See Specifications

11-211

11 21 571 REPLACING PILOT BEARING IN CRANKSHAFT

Remove clutch see 21 21 000
Pull out ball bearing with Special Tool 11 2 010

Installed Order
Ball bearing (1), cover (2), felt ring (3) and capsule (4)
Insert cover (2) with embossment facing out

Pack bore in crankshaft with about 1 gram of lubricating grease
Drive in pilot bearing with Special Tools 11 2 030 and 00 5 500



11 22 000 REMOVING AND INSTALLING FLYWHEEL

Remove clutch see 21 21 000
Hold flywheel with Special Tool 11 2 170
Unscrew bolts and take off flywheel

Installation:
Clean tapped bores
Insert ring (1)
Replace and install new expansion bolts with a bolt cement**
Tightening torque*

Check flywheel for axial runout*

Friction surfaces may be machined to minimum distance A*
If machining the friction surface reduces distance "h" to zero, the flange surface (distance "h") must be machined

Friction surfaces of double mass flywheels cannot be machined

min. 0.1 mm

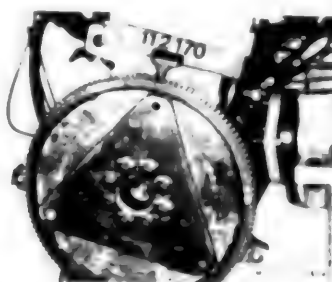


11 22 051 REPLACING DRIVE PLATE FOR TORQUE CONVERTER

Remove transmission see Group 24
Hold flywheel with Special Tool 11 2 170
Unscrew bolts and take off flywheel

Installation:
Clean tapped bores
Replace and install new expansion bolts with a bolt cement**
Tightening torque*

* See Specifications
** Source: HWB



11-212

11 23 010 REPLACING VIBRATION DAMPER

Remove fan 11 52 000
 Take off drive belt on alternator, power pump and if applicable compressor for air condition
 or
 Unscrew pulley
Installation
 Tighten drive belt and check tightness with Special Tool 11 5 020

Unscrew pulley and vibration damper on hub
Installation
 Centering pin must fit in bore in vibration damper



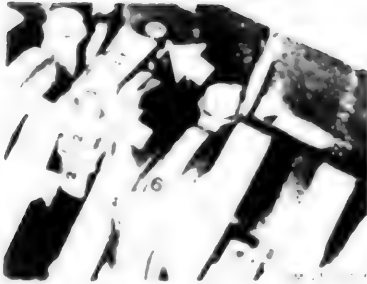
11 23 031 REPLACING VIBRATION DAMPER HUB

Remove radiator 17 11 000
 Remove vibration damper 11 23 010
 Hold hub with Special Tool 11 2 150
 Unscrew bolt (3)
 Take off collar washer (4)
Installation
 Tightening torque*

Screw in bolt (3) about three turns
 Pull hub off of crankshaft with Special Tools 00 7 501 and 11 2 132
 Unscrew bolt (3)

* See Specifications

11-213

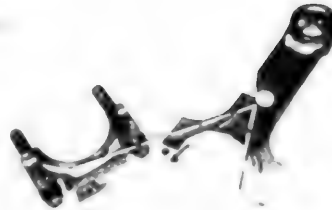


11 24 521 REPLACING CONNECTING RODS PISTONS REMOVED

Important

Only install connecting rods of same weight class in one engine.
Weight class is die-stamped in machined conrod bearing cap surface.
Connecting rods may not be reground.

Piston pin should slide through connecting rod bushing under light pressure.



11 24 571 REPLACING CONNECTING ROD BEARING SHELLS ENGINE DISASSEMBLED

Install red or blue bearing shells in connecting rod depending on color code on crankshaft counterweight.

Check machined size (conrod diameter).



Install red or blue bearing shells in connecting rod bearing cap depending on color code on conrod bearing caps.
In BDC position place Type PG 1 plastigage on crankshaft, wiped clean of oil and install conrod bearing caps that lubricating grooves are on one side.

Paired code numbers (0-99) must be same on caps and connecting rods.

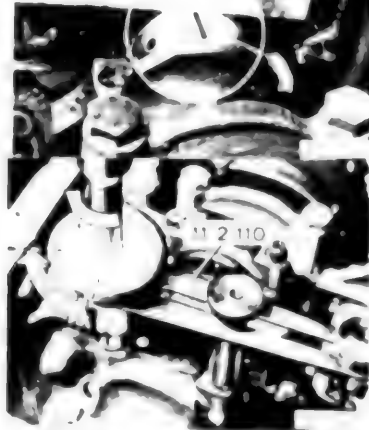
Source for Plastigage:

Cartool
Alfred Brehm Str. 5
D-8070 Ingolstadt
West Germany

Tighten bolts in two steps (use old conrod bolts).
Step 1 - 20 Nm (15 ft. lbs.)
Step 2 - torque angle of 70°.

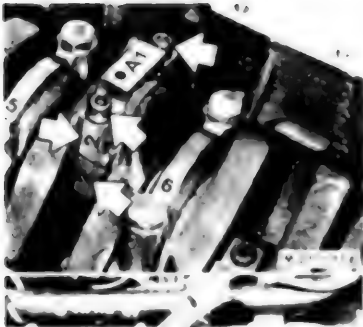
Important

Don't turn connecting rods or crankshaft.
Remove bearing caps.
Read bearing play* from width of flattened Plastigage with help of supplied scale.
Correct bearing play by installing new bearing shells bearing shells of different machined size or with different color code.
Use new conrod bolts for final assembly and tighten connecting rod bearing cap bolts in two steps (see above).



* See Specifications.

11-214



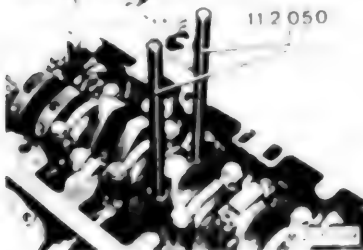
11 25 000 REMOVING AND INSTALLING PISTON

Remove engine

Take off cylinder head, oil pan and oil pump.
Remove connecting rod bearing cap.

Important:

Mark installed position of connecting rod to crankshaft. If conrod bearing shells do not have to be replaced.



11 2 050

Screw Special Tool 11 2 050 on connecting rod to avoid damage on oil spray jet (3).
Press out piston upwards.

Remove circlip (1).
Press out piston pin.

Installation:

Piston pins and pistons are matched and must not be mixed up.



M 21 D



M 21 D



Only install a piston of same make and same weight class.
Weight class is die stamped with "A" or "B" on piston crown.
Check machined size (piston diameter)*.

Check piston installed clearance*

Model	Make	Measuring Point A
M 21 D	Alcan	15.00 mm (0.591")
	KS	18.00 mm (0.709")
	Mahle	12.00 mm (0.472")
	Kong	

Set internal calipers to zero on micrometer with the measured piston diameter.

Measure cylinder bore with internal calipers at bottom, center and top in forward and rotational directions.
Check piston installed clearance*.

* See Specifications

11-215



11 2 260

Lubricate piston and piston rings with oil.
Offset piston ring end gaps by 120° to each other.
Compress piston rings with Special Tool 11 2 260.



11 2 260

11 25 651 REPLACING PISTON RINGS OF ONE PISTON

Piston Removed

Measure side clearance* of piston rings (only possible on rings 2 and 3).

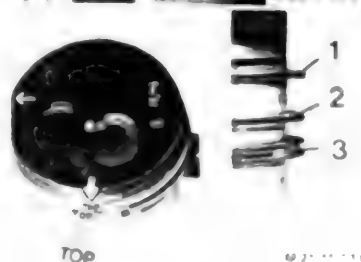
Screw Special Tool 11 2 050 on to connecting rod to avoid damaging oil spray jet (3).



Remove piston rings and measure end clearance.

11 2 050

Insert piston that arrow points to the toothed drive belt.
Install connecting rod - see 11 24 521.



11 2 050

Install piston rings with the word TOP facing the piston crown.

- 1 Double wedge compression ring
- 2 Bevelled face compression ring
- 3 Oil scraper ring with rubber lined spring

It might not be possible to find the identification on used piston rings.
Lay piston rings aside in correct sequence and installed position.

See Specifications.

11-216

11 31 000 REMOVING AND INSTALLING CAMSHAFT

Remove air cleaner - see Group 13
Remove fan - 11 52 000
Turn crankshaft to have TDC in cylinder no. 1 and overlapping in cylinder no. 6

Hold crankshaft with Special Tool 11 2 300

Unscrew hose (5) and cover.
Remove vacuum pump - 11 66 000
Remove rocker arm for exhaust in 2nd cylinder and for intake in 3rd cylinder to take tension off of camshaft. See 11 33 031

Loosen bolts (1 ... 2) and nut (3).
Loosen toothed belt and take it off of camshaft sprocket.

Unscrew bolt (1) and remove camshaft sprocket.

Installation:

Tightening torque*

Installation:

Slide slot of pulley and bore of washer (2) over pin of camshaft

Unscrew camshaft

Installation:

Replace rocker arms when replacing a camshaft because of worn cams!

Slide steel ring over cam for vacuum pump

Bearings are marked

Bearing no. 1 is at front end

See 11 12 240 for installation of bearing no. 1

with insertion of radial oil seal

Mount oil line

Check camshaft axial play*

Install and tighten toothed belt, see 11 31 110

Codes of Camshafts

Engine	Code
M 21 D 24 W	S
M 21 D 24 WA	E / T

* See Specifications

* See Specifications

11-217

11 31 100 TIGHTENING TOOTHED DRIVE BELT

Remove air cleaner see Group 13
Remove fan 11 52 000

Turn cylinder no. 1 to TDC, valves of cylinder no. 6 overlap

Hold crankshaft with Special Tool 11 2 300

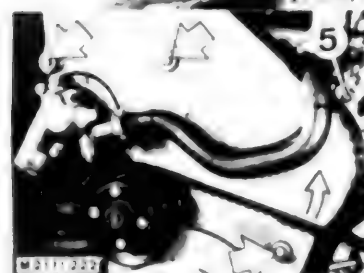
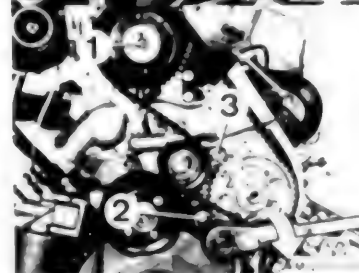
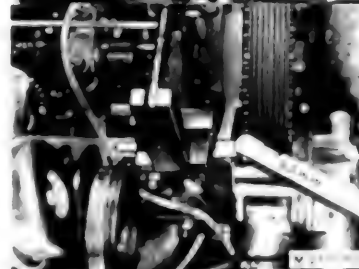
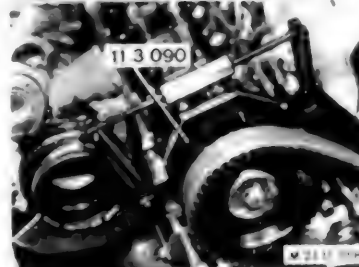
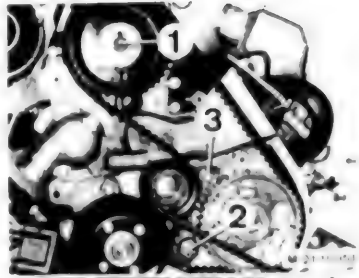
Disconnect hose (5) and unscrew cover
Remove cylinder head cover 11 12 000

Loosen bolts (1 and 2) and nut (3)

Hold camshaft in position with Special Tool 11 3 090 with cylinder no. 1 at TDC and valves of cylinder no. 6 overlapping

Important:
Tighten toothed drive belt with coolant temperature between 15 and 35°C (60 and 95°F).
Use a 2.5 mm (0.098") feeler gage blade on the exhaust side for a new toothed drive belt or a belt used less than 15,000 km (10,000 miles).

Press out tensioning roller with a torque wrench (analog display).
Torque for toothed drive belt used up to 15,000 km (10,000 miles) = 42 ± 3 Nm (30 ± 2 ft. lbs.) or from 15,000 km (10,000 miles) on = 30 to 35 Nm (22 to 25 ft. lbs.).
Tighten nut (3) and then bolts (1 and 2).
Check tightening torque for bolt (1).
Crank engine once in rotating direction and recheck timing.
Make static injection pump adjustment see 13 51 005.



11-218

11 31 110 REMOVING AND INSTALLING TOOTHED DRIVE BELT

Remove air cleaner - see Group 13
Remove fan - 11 52 000

Turn crankshaft for TDC in cylinder no. 1 and overlapping in cylinder no. 6

Hold crankshaft with Special Tool 11 2 300

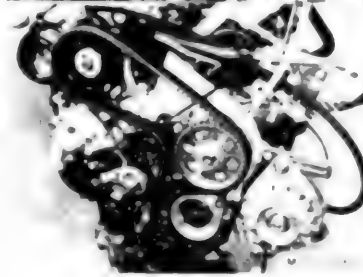
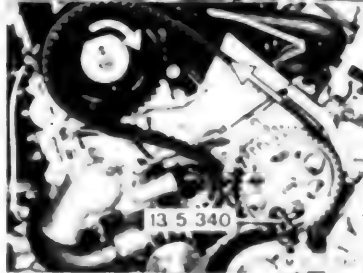
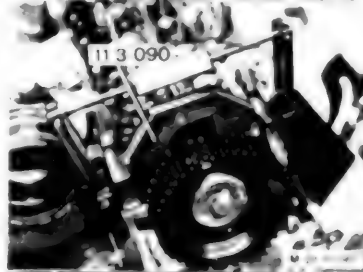
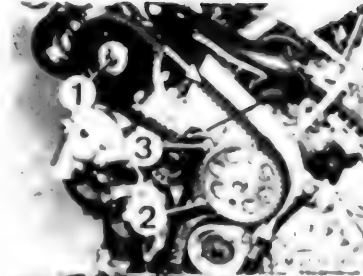
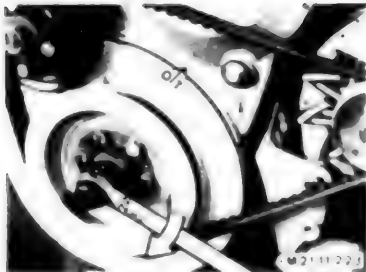
Disconnect hose (5) and remove cover
Remove vibration damper - 11 23 010
Remove cylinder head cover - 11 12 000

Loosen bolts (1 and 2) and nut (3)
Mark running direction of toothed drive belt and take off belt

Installation:
Hold camshaft with Special Tool 11 3 090
TDC in cylinder no. 1 and overlapping in cylinder no. 6

Hold injection pump gear wheel with Special Tool 13 5 340 for rough adjustment of the injection pump
Install toothed drive belt in opposite direction of engine rotation - turn loose camshaft sprocket against toothed drive belt completely
Remove Special Tool 13 5 340
Tighten toothed drive belt - see 11 31 100

Toothed Drive Belt Layout
Adjust injection pump statically - see 13 51 005



11-219

11 33 050 REPLACING ROCKER ARM

Remove vacuum pump 11 66 000
Pull off spring clip (1)
Pertinent cams of camshaft must be turned up
for removal of rocker arms

Press down valve springs with Special Tool
11 3 120 and remove rocker arm watching
out for valve collars

Important:
Install rocker arm with same ball headed bolt.
When replacing rocker arms it is always neces-
sary to also replace the ball headed bolts.

Pull out ball headed bolt with Special Tool
11 3 140

Important:
Install ball headed bolt with a bolt cement**
and press in against stop

Important:
Press spring clip into groove of ball headed bolt
Adjust valve clearance 11 34 004

** Source HWB

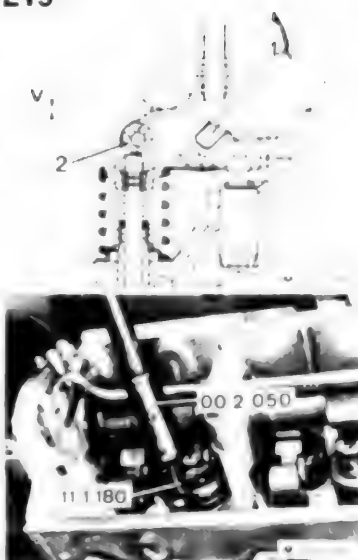
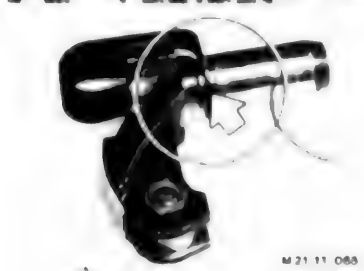
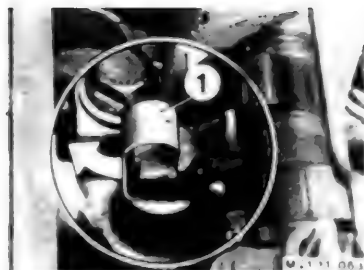
11 34 004 ADJUSTING VALVE CLEARANCE

Remove cylinder head cover 11 12 000
Turn engine to TDC with a wrench socket used
on crankshaft (vibration damper)
Apply a 12 mm open end wrench on nut (1) for
counterholding and unscrew nut on adjusting
eccentric (2)
Adjust valve clearance "V" eccentric always
turned toward outside
Make adjustments in firing order 1 5 3 6 2 4
Tighten in compression TDC
Tighten nut with Special Tools 11 1 180 and
00 2 050
Tightening torque*

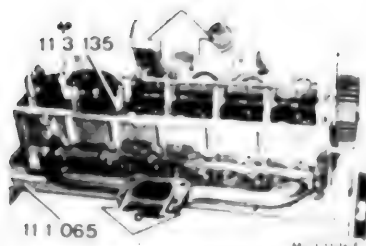
11 34 509 CHECKING VALVES FOR LEAKS — Camshaft Removed

Fill intake and exhaust ports with gasoline
outdoors or indoors with strict conformance
of fire prevention regulations
Valves and valve seats must be inspected if the
gasoline runs past the valve heads
Remove and install valves 11 34 550
Machine valve seats 11 12 607

* See Specifications



11-220

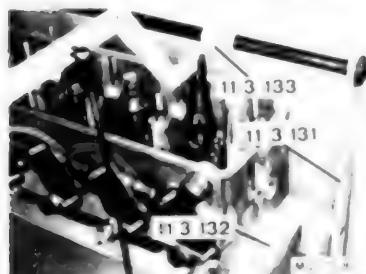


11 34 550 REMOVING AND INSTALLING VALVES

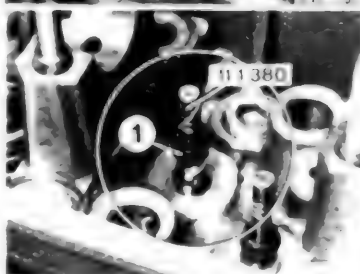
Remove cylinder head - 11 12 000
Remove thermostat housing and mount cylinder head on Special Tool 11 1 065 with Special Tool 11 3 135
Unscrew intake manifold and exhaust manifold
Installation:
Replace gaskets



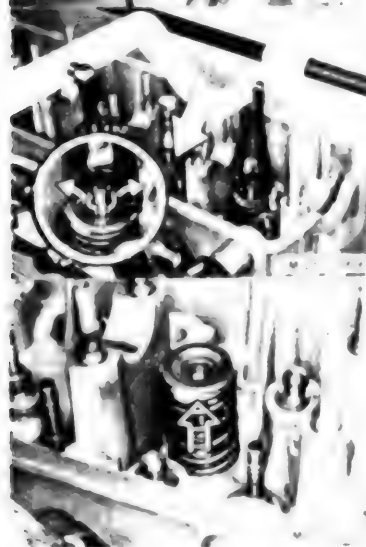
Pull off valve stem seal with Special Tool 11 1 250



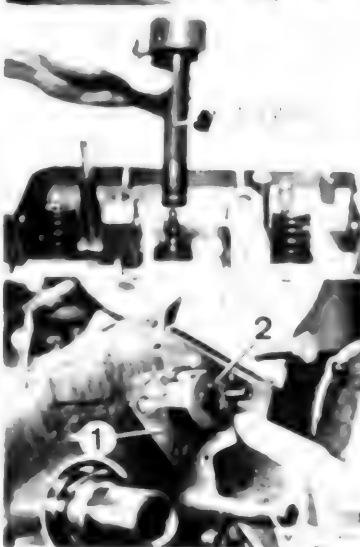
Remove camshaft - see 11 31 000
Mount Special Tools 11 3 131 - 133 and place 11 3 132 (tray) in assembly fixture
Remove rocker arm



Install valve
Always use sleeves to avoid damaging valve stem seals
Lubricate valve stem seal (1) with oil and install
Source for Sleeves
Carltool
Alfred Brehm Str. 5
D 8070 Ingolstadt



Press down valve springs and remove valve collets



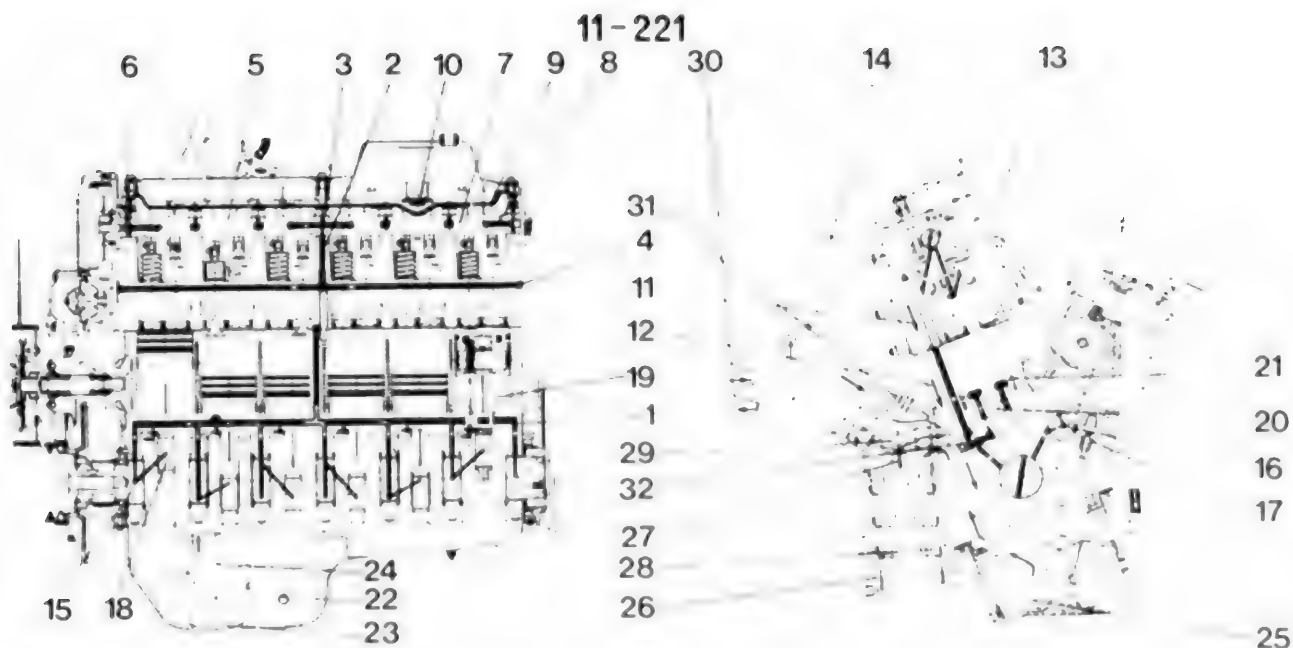
Press on valve stem seal against stop with Special Tool 11 1 170
New improved valve stem seals with grooves on the inside are pressed on by hand with Special Tool 11 1 200
Special Tool 11 1 200 has two diameters for 7 mm (0 276) and 8 mm (0 315) valve stem seals

Take off upper spring retainers, valve springs and lower spring retainers
Take tray out of assembly fixture and pull out valves
Installation:
Only install valve springs with same color code wire gage size and length
Lubricate valve guides and valve stems with oil
Measure valve retraction R* - see 11 12 607

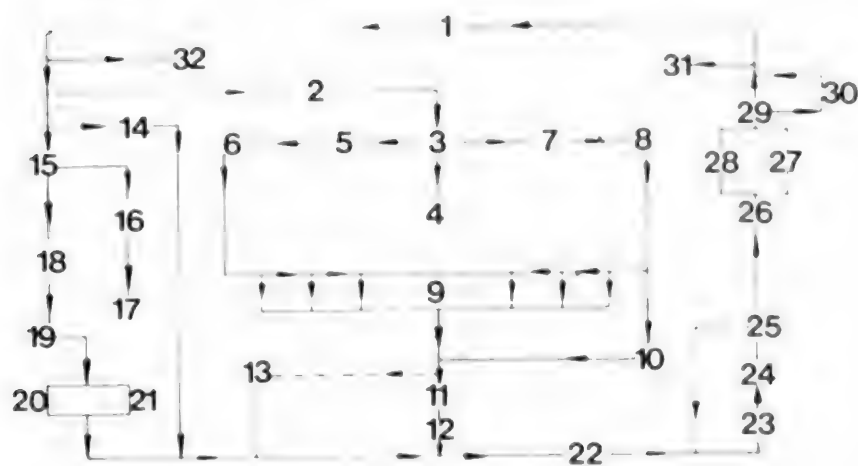
11 35 020 REMOVING AND INSTALLING INTERMEDIATE SHAFT

Remove front end cover - 11 14 175
Unscrew guide plate (1)
Pull out intermediate shaft (2) - turning crankshaft if necessary
Installation:
Check gear replacing intermediate shaft if necessary
Bearings in crankcase cannot be replaced

* See Specifications



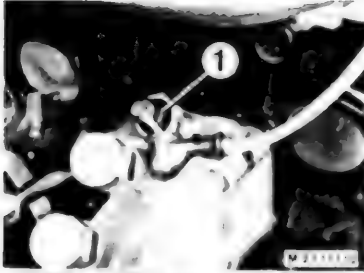
*121 11 086



ENGINE OIL CIRCUIT

- | | |
|--|--|
| 1 Main distribution bore in crankcase | 19 Spray oil |
| 2 Oil entry bore in cyl. head | 20 Piston pins |
| 3 Camshaft bearing center | 21 Cylinder walls |
| 4 Distributing bore in cyl. head | 22 Oil pan |
| 5 Hollow camshaft | 23 Fuel intake with filter screen |
| 6 Camshaft bearing front | 24 Oil pump |
| 7 Hollow camshaft | 25 Engine oil pressure regulating valve in oil pump (open with pressure of 5.5 to 6.5 bar - 78 to 92 psi) |
| 8 Camshaft bearing rear | 26 Oil filter volume 1.2 ltr (2.4 gti) |
| 9 Oil supply line with open jets for cams on outside valve guides and ball headed pins for rocker arms | 27 Safety valve (open with pressure of 2.5 bar - 35 psi; oil supply guaranteed even with filter cartridge clogged) |
| 10 Eccentric for vacuum pump | 28 Filter cartridge |
| 11 Spill from cylinder head | 29 Thermostat |
| 12 Drain to oil pan | 30 Oil cooler |
| 13 Oil trap (crankcase vent) | 31 Connection for oil pressure transmitter of indicator lamp |
| 14 Turbocharger | 32 Oil spray jet (piston cooling) (open with pressure of 1.5 to 2 bar - 21 to 28 psi) |
| 15 Crankshaft bearings | |
| 16 Intermediate shaft bearings and guide plate | |
| 17 Spray oil for gear wheels (oil pump drive) | |
| 18 Conrod bearings | |

11-222

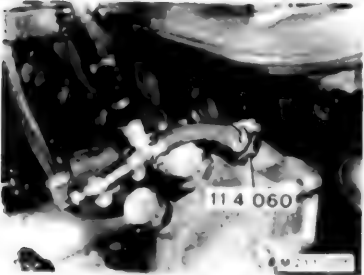


11 40 000 CHECKING ENGINE OIL PRESSURE

Disconnect wire on oil pressure switch
Unscrew oil pressure switch (1)

Installation:

Check gasket, replacing if necessary



Screw in Special Tool 11 4 060
Connect 10 bar (142 psi) pressure tester of
BMW service test unit
Check oil pressure*

* See Specifications

11-223

11 41 000 REMOVING AND INSTALLING OIL PUMP

Remove oil pan 11 13 000
Remove oil pump

Installation
Guide drive shaft (1) into bearing
Replace bearing, see 11 11 160

Testing and Servicing
Unscrew cap (2) and clean oil filter screen (3)

Check whether gears move easily by turning the drive shaft

Unscrew oil pump cover and inspect oil pump for wear

Scoring in body - cover
Wear on gears

The engine oil pressure regulating valve regulates the engine oil pressure*
Check that piston (5) moves easily
Check length of spring (6) = 71.6 mm (2.819")

Installation
Press in spring (6) and washer (7), and hold in with a screwdriver
Install circlip (8)

* See Specifications

11-224

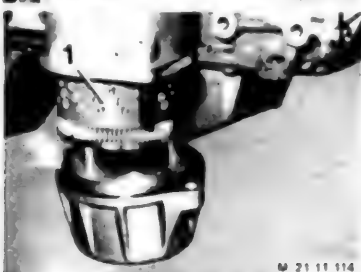


11 42 020 REPLACING OIL FILTER

Unscrew oil drain plug in oil filter and drain oil.

Installation:

Tightening torque*



Unscrew cap and pull out oil filter (1).

Installation:

Replace seal.

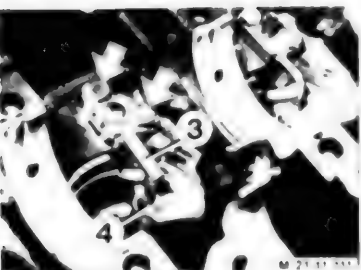
Add oil** and ***

Tightening torque*

11 42 650 REMOVING AND INSTALLING REPLACING OIL SPRAY JET — Crankshaft Removed —

Engine oil is injected into annular bore (4) of piston via oil spray jet (3) for piston cooling. A guarantee that oil stream meets bore (4) could not be given were oil spray jet (3) even slightly damaged. Follow up damage would be immediate engine failure.

Unscrew screws and take out oil spray jet (3).



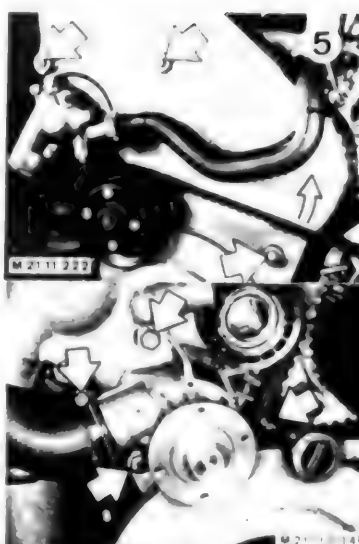
* See Specifications

*** See Service Information of Gr. 00

11 51 000 REMOVING AND INSTALLING WATER PUMP

Remove air cleaner - see Group 13

Remove fan - 11 52 000



Take off drive belt and unscrew pulley.

Disconnect hose (5) and unscrew cover.

Installation:

Tighten drive belt and check tightness with

Special Tool 11 5 020.

Detach water hose.

Unscrew water pump.

Note:

Only push toothed belt to one side.



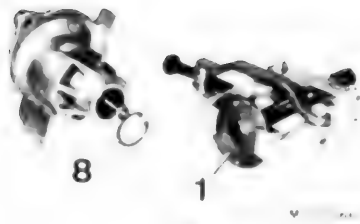
Installation:

Replace gasket (1).

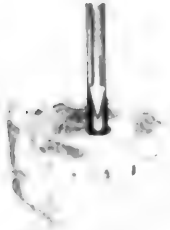
11-225

11 51 502 OVERHAULING WATER PUMP - WATER PUMP REMOVED

Pull off hub (1) with Special Tool 00 8 500
Remove circlip (8)



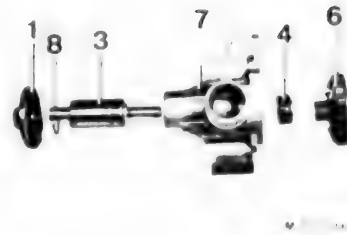
Press out water pump bearing



Drive out seal (4)

Installation

Lubricate seal (4) with oil and press in with
Special Tool 00 5 550



Replace bearing (3) and seal (4)

Check impeller (6), replacing if necessary

1 = Hub

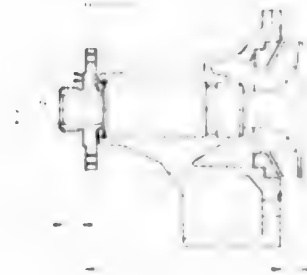
7 = Water pump body

Installation

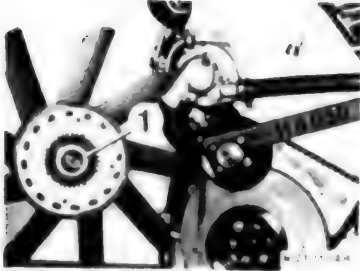
Press in bearing (3) against stop

Press on impeller (6)

Check assembled distances



11-226

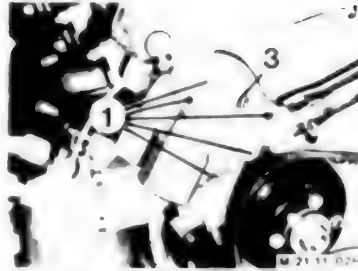


11 52 000 REMOVING AND INSTALLING FAN

Remove fan cowl
Hold pulley with Special Tool 11 5 030 and unscrew coupling nut (1)
Important!
Left hand threads — turn nut clockwise to unscrew
Tightening torque*

Installation

Tighten fan with Special Tool 11 5 040
40 Nm (29 ft. lbs.) tightening torque is equal to 30 Nm (22 ft. lbs.) setting on the torque wrench

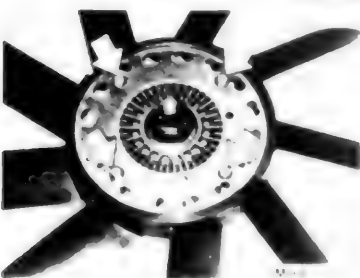


11 53 000 REMOVING AND INSTALLING COOLANT THERMOSTAT

Remove fan — see 11 52 000
Drain coolant partially
Remove caps (1)
Remove thermostat

Installation

Bar on thermostat faces out
Replace rubber ring (2) and gasket
Loosen bleeder screw (3) with engine at operating temperature heater set to "warm" and engine running at fast idle speed
Tighten bleeder screw again when escaping coolant is without air bubbles



11 52 020 REPLACING FAN CLUTCH

Remove fan — see 11 52 000

Replace fan clutch when

- a) hub has seized (fan ok stopped engine cannot be turned or hard to turn)
- b) fan clutch has axial/radial play or is losing oil

Check switching points* with Vibrocard***
Unscrew fan mounting bolts and take off fan clutch



Testing Thermostat

Does thermostat begin to open at specified temperature?

Check opening temperature by placing the thermostat in a hot water bath and comparing actual opening temperature against stamped value

11 53 080 REPLACING TEMPERATURE TRANSMITTER

Pull off plug — unscrew transmitter

Installation

Replace seal

Tightening torque*

Testing — see Group 12



* See Specifications
*** See Workshop Equipment Catalog

* See Specifications

11 Engine M30 since E32

11 12 000	Cylinder head cover – remove and install	11- 351
101	Cylinder head gasket – replace	11- 351
500	Cylinder head – remove and install (engine removed)	11- 352
595	Valve guide – inspect for wear	11- 354
600	Valve guide – ream	11- 354
607	Valve seats and valves – machine (cylinder head disassembled)	11- 354
719	Cylinder head sealing surface – machine (cylinder head disassembled)	11- 355
729	Cylinder head – check for cracks in water test (cylinder head disassembled)	11- 355
11 14 100	Timing case cover, upper – remove and install/seal	11- 356
120	Timing case cover, lower – remove and install/seal	11- 357
131	Radial oil seal in upper timing case cover – replace	11- 358
141	Radial oil seal in lower timing case cover – replace	11- 358
605	Radial oil seal in clutch end cover – replace	11- 359
11 21 000	Crankshaft – remove and install	11- 360
501	Crankshaft – replace (crankshaft removed)	11- 361
531	Crankshaft main bearing shells – replace (engine disassembled)	11- 361
571	Pilot bearing in crankshaft – replace	11- 362
11 22 000	Flywheel – remove and install	11- 363
051	Drive plate for torque converter – replace	11- 363
541	Starter gear ring – replace	11- 363
11 23 010	Vibration damper – replace	11- 364
031	Vibration damper hub – replace	11- 364
11 24 521	Connecting rod – replace (piston removed)	11- 365
571	Connecting rod bearing shells – replace (engine disassembled)	11- 365
11 25 000	Piston – remove and install	11- 366
651	Piston rings of one piston – replace (piston removed)	11- 367
11 31 000	Camshaft – remove and install (cylinder head removed)	11- 369
001	Camshaft – replace (camshaft removed)	11- 370
051	Timing chain – replace	11- 370
061	Timing chain sprockets – replace (timing chain removed)	11- 371
090	Timing chain tensioner piston – remove and install	11- 371
601	Timing chain tensioning rail / guide rail – replace (timing chain removed)	11- 372
11 33 020	Rocker arm shafts – remove and install	11- 373
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500	Valves – check for leaks (camshaft removed)	11- 374
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151	Oil pump drive chain – replace	11- 377
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11 43 101	Oil dipstick guide tube – replace	11- 379
11 51 000	Water pump – remove and install	11- 379
11 52 000	Fan – remove and install	11- 380
020	Fan clutch – replace	11- 380
11 53 000	Coolant thermostat – remove and install	11- 380

11-323

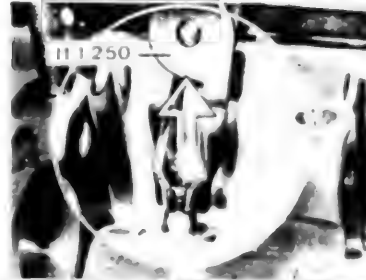
11 34 550 REMOVING AND INSTALLING VALVES Rocker Arm Shafts Removed

Place Special Tool 11 1 064 (tray) in Special Tool 11 1 060

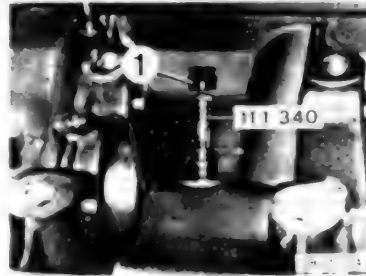
Press down valve springs with Special Tool 11 1 060 and remove collets.

Remove upper spring retainer, valve springs, and lower spring retainer.
Take tray out of special tool fixture and pull out valve.

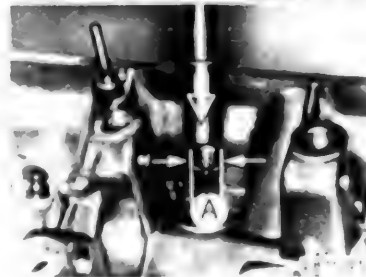
Installation:
Only install valve springs with same color code wire gauge size and length.
Lubricate valve guide and valve stem with oil.



Pull off valve stem seal with Special Tool 11 1 250.



Install valve.
Use Special Tool 11 1 340 to avoid damaging the valve stem seal.
Lubricate valve stem seal (1) with oil and install.
Special Tool Source:
Carltool
Alfred Brehm Str. 10
D-8070 Ingolstadt

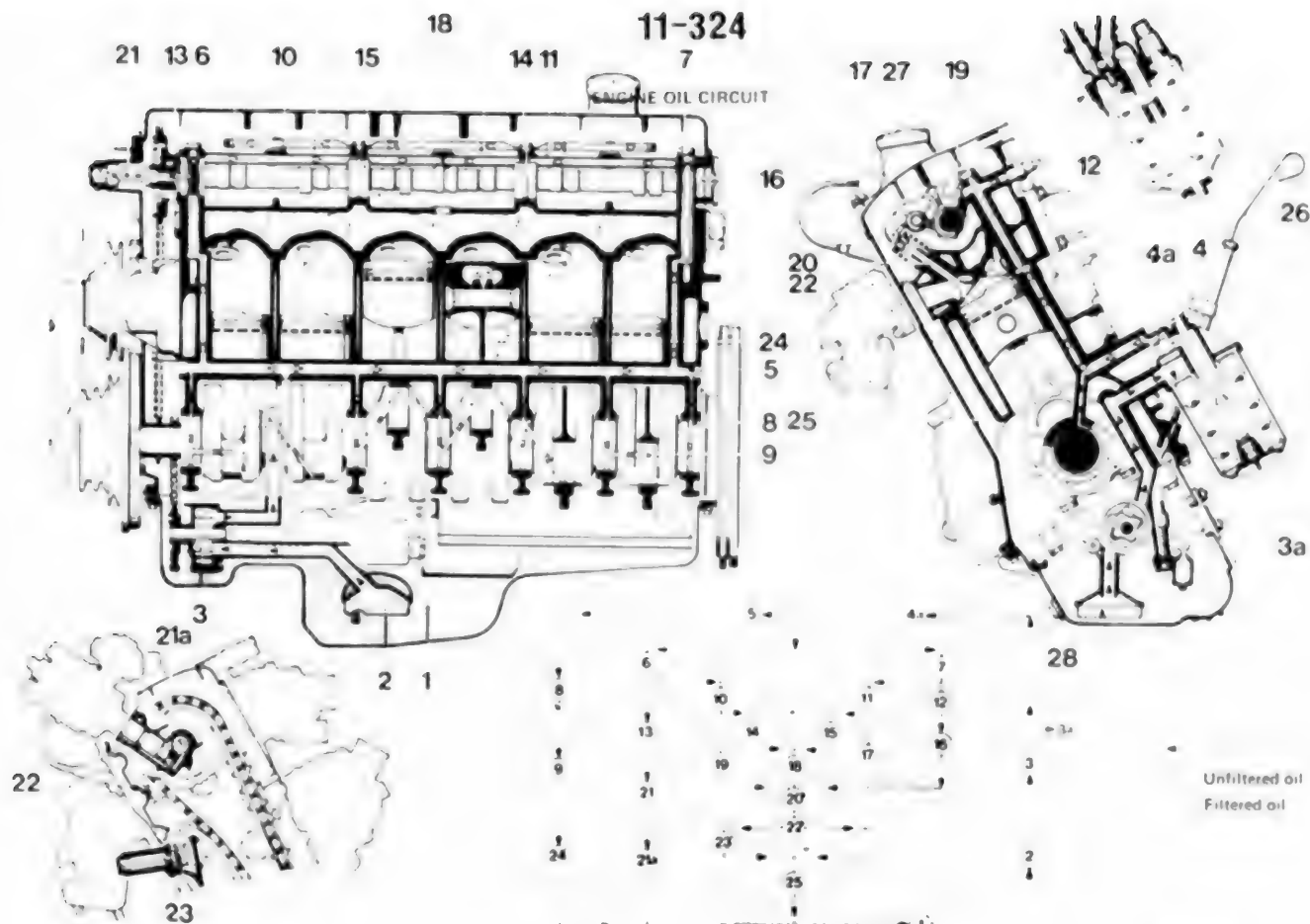


Press on valve stem seal against stop with Special Tool 11 1 090 when diameter A 14.0 ± 0.2 mm (0.551 ± 0.008") or Special Tool 11 1 070 when diameter A 14.3 ± 0.2 mm (0.563 ± 0.008").



New, improved valve stem seals with grooves on the inside are pressed on by hand with Special Tool 11 1 200.
Special Tool 11 1 200 has two diameters for 7 mm (0.279") and 8 mm (0.315") valve stem seals.

11-324



- 1 Oil pan
- 2 Intake with filter screen
- 3 Oil pump
- 3a Pressure relief valve
- 4 Oil filter
- 4a Safety valve (oil filter)
- 5 Main distribution passage
- 6 Front oil bore in cylinder head

- 7 Rear oil bore in cylinder head
- 8 Crankshaft bearing
- 9 Conrod bearing
- 10 Hollow rocker arm shaft, front
- 11 Hollow rocker arm shaft, rear
- 12 Transmitter for oil pressure indicator lamp
- 13 Front camshaft bearing
- 14 Camshaft bearing

- 15 Camshaft bearing
- 16 Rear camshaft bearing
- 17 Exhaust rocker arm bearing
- 18 Spray jets for camshaft lubrication
- 19 Intake rocker arm bearing
- 20 Valve guide
- 21 Bore in distributor drive
- 21a Spray oil for distributor drive

- 22 Overflow from cylinder head
- 23 Pocket / chain lubrication
- 24 Spray oil for piston pin
- 25 Oil drain bore
- 26 Oil dipstick
- 27 Oil filler neck
- 28 Oil drain bolt

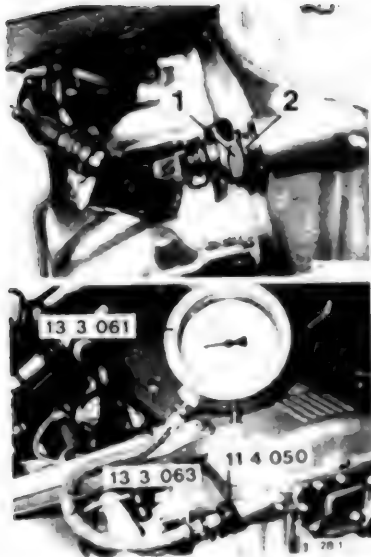
Unfiltered oil
Filtered oil

11-325

11 40 000 CHECKING ENGINE OIL PRESSURE

Pull off wires on oil pressure switch
Unscrew oil pressure switch (1)
Amorhalla
Check gasket (2), replacing if necessary

Screw in Special Tool 11 4 050
Connect hose 13 3 063 in conjunction with pressure tester 13 3 061
Check oil pressure*



11 41 000 REMOVING AND INSTALLING OIL PUMP

Pull out oil dipstick
Remove oil pan 11 13 000
Unscrew nut (1) and take off sprocket
Unscrew bolts (2)

Unscrew holder (3) and remove oil pump

Installation
Mount holder without tension

Installation
Push on sprocket after mounting oil pump
Tightening torque* for nut

Installation Chain Tightness
Adjust chain tightness with shims (4 and 5) that chain will give at center under light thumb pressure
Shims (4 and 5) must have the same thickness



* See Specifications

11-326

Testing and Servicing

Check whether oil pump runs easily by turning the drive shaft

Disassemble oil pump and clean oil filter screen (5)

Check oil pump for wear
- Scoring in body
- Wear on rotors

The pressure relief valve is installed in the main bore and regulates the engine oil pressure*, see 11 40 000
Check whether piston (6) moves easily
Check length of spring (7) = 68 mm (2 677")

* See Specifications

The 8 bar (112 psi) pressure relief valve regulates the oil pressure in front of the oil filter and prevents oil filter leakage
Check piston seat (8)
Check length of spring (9) = 44 ± 0.4 mm (1 732 ± 0.016")

Installation

Press in spring (9) and washer (10) with a wrench socket and install circlip (11)

11 41 151 REPLACING OIL PUMP DRIVE CHAIN

Remove oil pan 11 13 000
Remove timing chain 11 31 051
Unscrew nut (1) and take off sprocket

Installation

Adjust chain tightness, see 11 41 000
Chain with green color code are longer than chains with red color code
Tightening torque*

* See Specifications

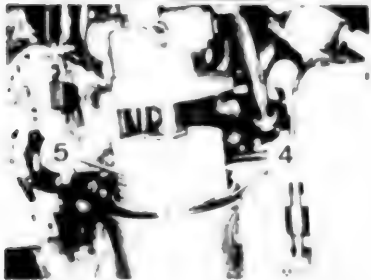
11-327

11 42 021 REPLACING FULL FLOW OIL FILTER

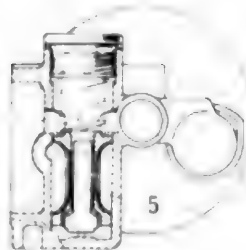
Unscrew oil drain plug (1) and drain oil
Unscrew bolt (2)
Replace oil filter (5)

Installation

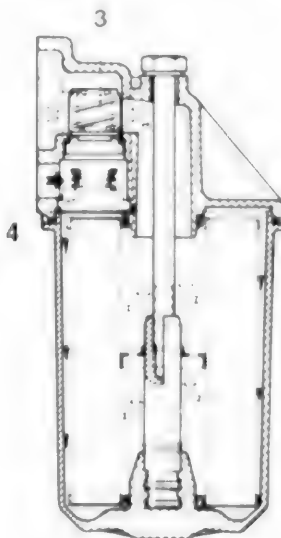
Check seals (3 and 4), replacing if necessary
Mount oil filter housing that arrow faces forward (FRONT)
Tightening torque*
Add engine oil***



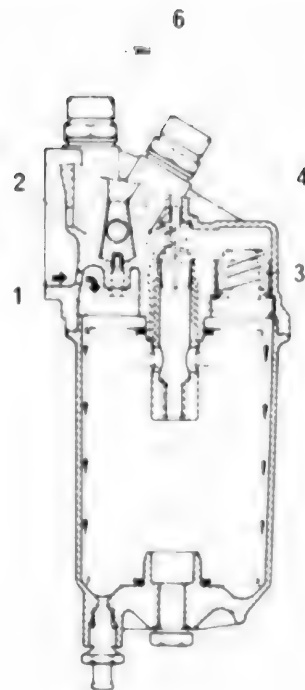
- 1 Feed from pump
- 2 Return to main oil bore
- 3 Bypass valve - opening pressure 2.5 - 0.25 bar (35 - 3 psi)
- 4 Return inhibiting valve - opening pressure 0.1 - 0.05 bar (1.4 - 0.7 psi)
- 5 Thermostatic activator for switching oil cooler
- 6 Oil cooler



Model B 34



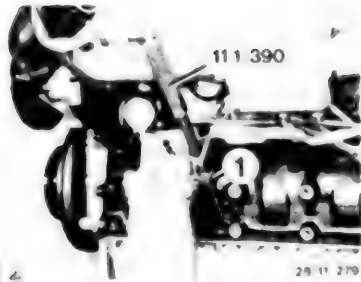
Model B 25
B 28
B 32



Unfiltered oil
Filtered oil

* See Specifications
*** See Service Information of Gr. 11

11-328



11 43 101 REPLACING OIL DIPSTICK GUIDE TUBE

Transfer clamp (1)
 Insert guide tube with Loctite No. 270** and knock in against stop
Inspection:
 Always check oil level with grip eye of oil dipstick facing left when looking forward.
 Non-conformance could cause incorrect reading.
 In other words engine oil volume* would not be amount specified.



11 51 000 REMOVING AND INSTALLING WATER PUMP

Remove fan 11 52 000
 Take off drive belt and remove pulley
Inspection:
 Tighten drive belt and check tightness with Special Tool 11 5 020



Detach suspension eye (1) and water hose (2)



Detach water pump
Inspection:
 Replace gasket

* See Specifications
 ** Source: HWB

11-329

11 51 502 OVERHAULING WATER PUMP

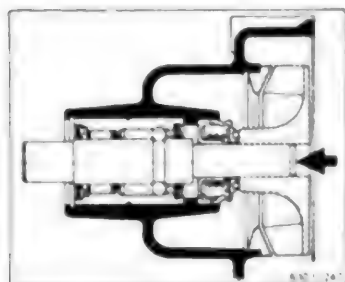
Check installed distances!



00 8 500

Pull off hub with Special Tool 00 8 500
Lift out circlip (1)

630 11 246

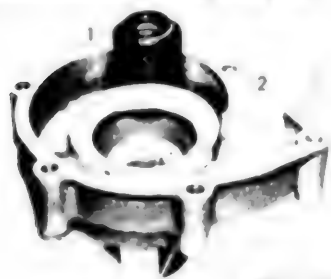
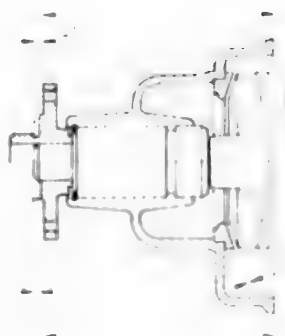


Press out water pump bearing

Installation

Press in water pump bearing against stop

Press on impeller



Drive out seal (1)

Installation

Press in seal (1) with Special Tool 00 5 550

630 11 247

11-330

11 52 000 REMOVING AND INSTALLING FAN

Hold pulley with Special Tool 11 5 030 and unscrew coupling nut (1)
Important!
 Left hand threads - turn nut clockwise to unscrew
 Tightening torque*

Installation:

Tighten fan with Special Tool 11 5 040
 40 Nm (29 ft. lbs.) tightening torque is equal to 30 Nm (22 ft. lbs.) setting on torque wrench.

11 52 020 REPLACING FAN CLUTCH

Remove fan - see 11 52 000

Replace fan clutch when

- hub has seized (fan of stopped engine cannot be turned or hard to turn),
- fan clutch has axial/radial play or is losing oil

Check switching points* with Vibrocard***.
 Unscrew fan mounting bolts and take off fan clutch

* See Specifications

*** See Workshop Equipment Catalog

11 53 000 REMOVING AND INSTALLING COOLANT THERMOSTAT

Drain coolant partially

Unscrew cover (1)

Installation:

Bleed cooling system - see 17 00 039

Remove thermostat.

Replace gasket (2) and seal (3)

Installation:

Bar on thermostat faces out

Since 1986 Models - Cast A

Install new thermostat no. 1 713 040 with seal (4) facing cover.

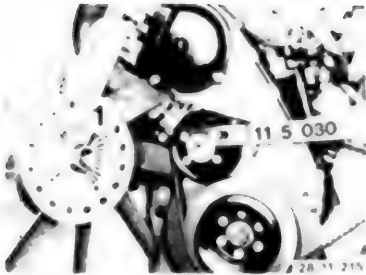
Only B 25 / B 28:

Gasket (2) omitted only after introduction of thermostat housing cover 11 53 1 714 861 (without notch in sealing surface).

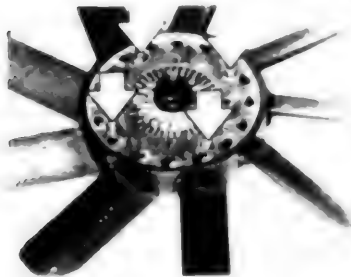
Testing Thermostat:

Does thermostat begin to open at specified temperature?

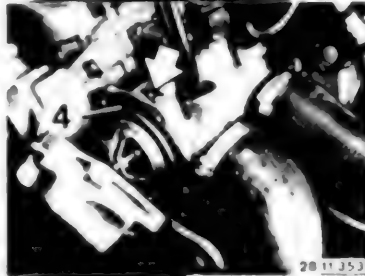
Check by placing thermostat in a hot water bath and comparing actual opening temperature against stamped value



30 11193



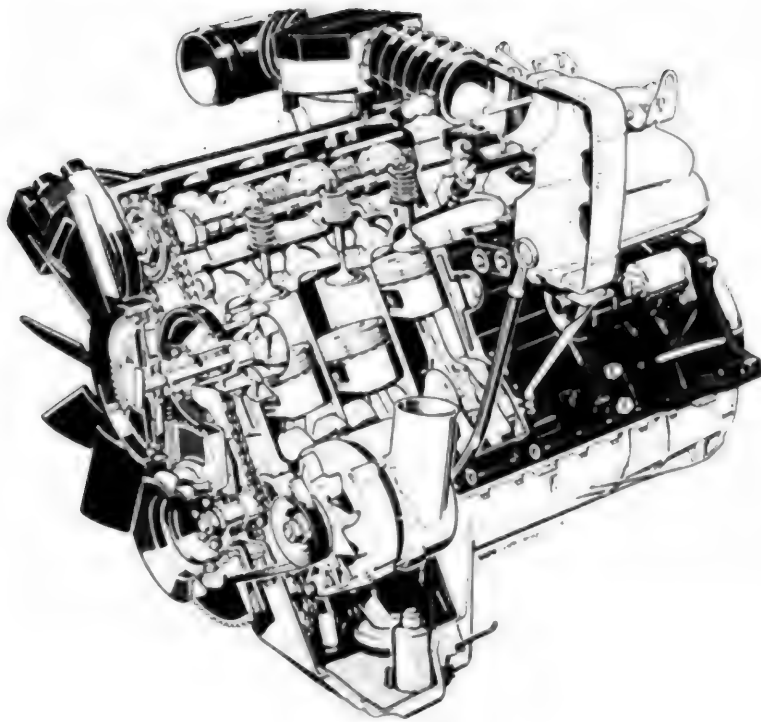
28 11 523



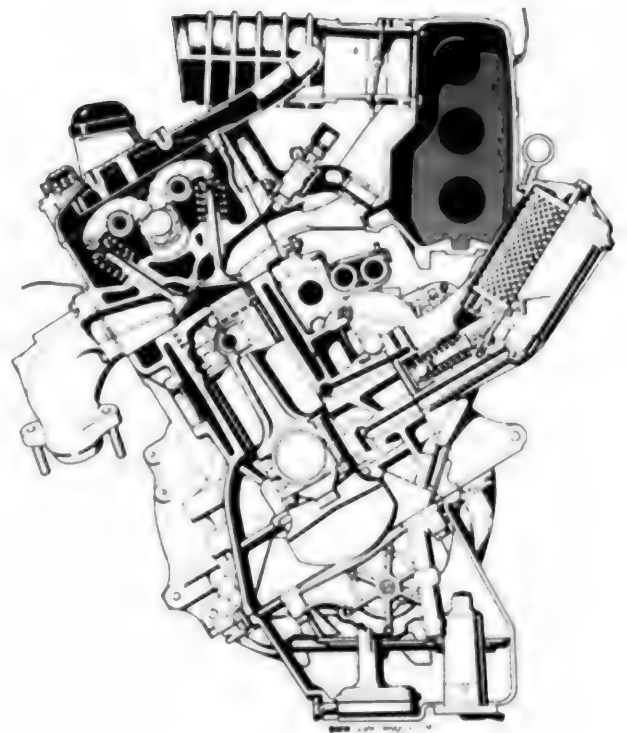
28 11 353



11-350

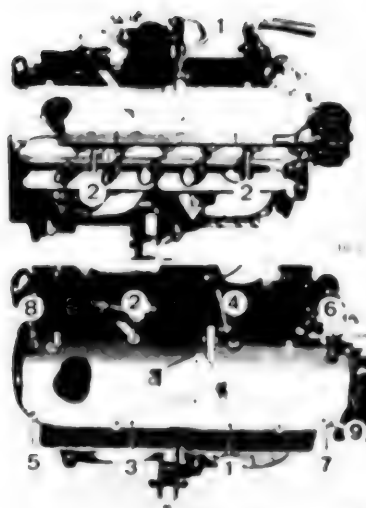


- M 30
- B
- 35
- M
- Z
- Large 6 cylinder
- Gasoline
- Displacement (x 100)
- Motronic
- Catalytic converter (worldwide)



- M 30 B 30 M = BMW 730 i
- M 30 B 30 M Z = BMW 730 i (Catalytic Converter)
- M 30 B 35 M = BMW 735 i
- M 30 B 35 M Z = BMW 735 i (Catalytic Converter)

11-351



11 12 000 REMOVING AND INSTALLING CYLINDER HEAD COVER

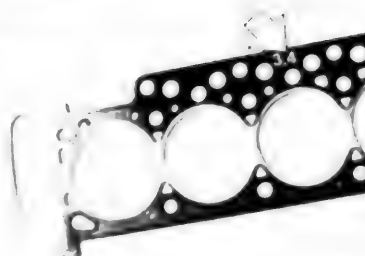
Disconnect hose (1)
Unscrew ignition lead tube (2)

Remove cylinder head cover

Installation

Check gasket, replacing if necessary.
Check for correct seating of gasket and
tighten bolts in order of 1 ... 9, mounting
the idle speed drive with bolt (2)

Tightening torque: 10 · 1 Nm (7 · 0.5 ft
lbs)



30.47

11 12 101 REPLACING CYLINDER HEAD GASKET

Remove cylinder head — see 11 12 100

Clean sealing surfaces on cylinder head and
crankcase — use a gasket remover** and hard
wood scraper

Check levelness with steel ruler (commercial)
and grind cylinder head sealing surface when
necessary — see 11 12 719

Installation

Only use original cylinder head gaskets, since
the openings and holes are matched precisely
for coolant flow

Stamped Identification

Engine	Code	Bore Diameter
M 30 B 30 M	3.0	89 mm (3.504")
M 30 B 35 M	3.4	92 mm (3.622")



Important!

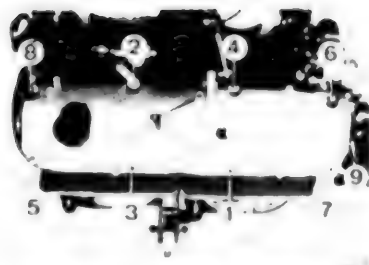
A 0.3 mm (0.012") thicker gasket can be
installed on a reground cylinder head, in order
to avoid reducing the specified combustion
chamber size.

This gasket can also be used when gasoline is
causing engine knock

Installation

Coat bores with Three Bond Silicone 1207**
before mounting the timing case cover

** Source: HWB



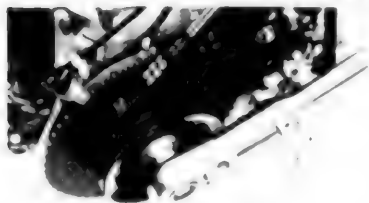
11 12 500 REMOVING AND INSTALLING
CYLINDER HEAD
- Engine Removed -

Unscrew cylinder head cover

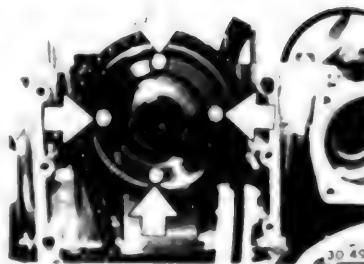
Installation

Check gasket, replacing if necessary
Check for correct seating of gasket and
tighten bolts in order of 1 ... 9, mounting
idle speed drive with bolt (2)
Tightening torque: 10 · 1 Nm (7 · 1 ft
lbs.)

Set cylinder no. 1 to TDC



10 421

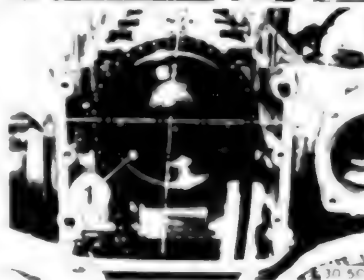


Remove upper timing case cover see 11 14 100

Remove piston for chain tensioner see

11 31 090

Unscrew sprocket



Installation

Mount chain that dowel pin (1) is at bottom
left when tapped bores are perpendicular to
the engine

Tightening torque: 10 · 1 Nm (7 · 0.5 ft lbs.)

10 501

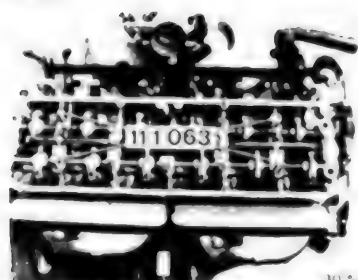
11-353



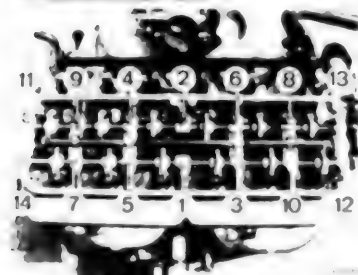
Disconnect hose



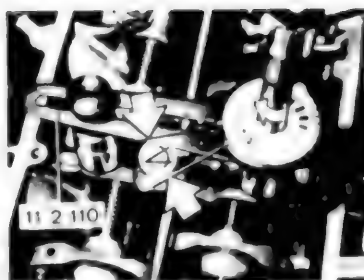
Unscrew support



Unscrew cylinder head bolts in order of 14 ... 1
Insert Special Tools 11 1 063 as shown in the picture to prevent the rocker arm shafts from moving or turning
Lift off the cylinder head

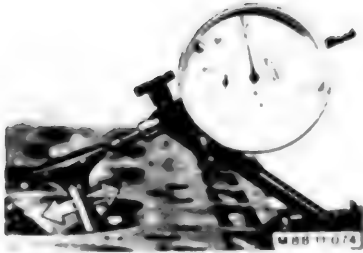


Installation
Keep oil out of cavities since otherwise bolts tightened with specified torque might not exert sufficient force on the cylinder head
In addition, the crankcase might be cracked
Clean cylinder head bolts
Lubricate threads and bearing surfaces of bolt heads with light coat of oil
Replace cylinder head gasket see 11 12 101



Tighten bolts in order of 1 ... 14 in 3 steps
Important!
In step 1 first tighten bolts (1 ... 6) with torque of $60 \pm 2 \text{ Nm}$ ($43 \pm 1.5 \text{ ft. lbs.}$), then remove Special Tools 11 1 063 and finally tighten bolts (7 ... 14)
Wait 15 minutes
Adjust valve clearance see 11 34 004
Step 2 = $33 \pm 3^\circ$ torque angle
Run engine warm 25 minutes, adjusting engine if necessary
Step 3 = $35 \pm 5^\circ$ torque angle

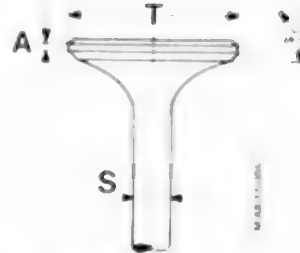
11-354



11 12 595 CHECKING VALVE GUIDE FOR WEAR

— Valve Removed —

To measure, install a new valve that the end of the valve stem is flush with the valve guide. Mount dial page and measure the tilt play. Max. permissible tilt play = 0.8 mm (0.031").



11 12 607 MACHINING VALVE SEATS AND VALVES

— Valves Removed —

The valve must be replaced, if the minimum edge thickness A cannot be held.

A Intake valve 1.3 mm (0.051")

A Exhaust valve 2.0 mm (0.079")

T Intake valve

M 30 B 30 46 mm (1.811")

M 30 B 35 47 mm (1.850")

T Exhaust valve 38 mm (1.496")

After machining the valve seat angle (45°), produce valve seat diameter M and valve seat width B by machining correction angles (15° / 75°). Grind in valves with grinding paste and check for leaks — see 11 34 509.

M Intake valve

M 30 B 30 44.6 mm (1.756")

M 30 B 35 45.6 mm (1.795")

M Exhaust valve 36.6 mm (1.441")

B Intake valve 1.4 ± 0.4 mm

(0.055 ± 0.016")

B Exhaust valve 1.7 ± 0.4 mm

(0.067 ± 0.016")

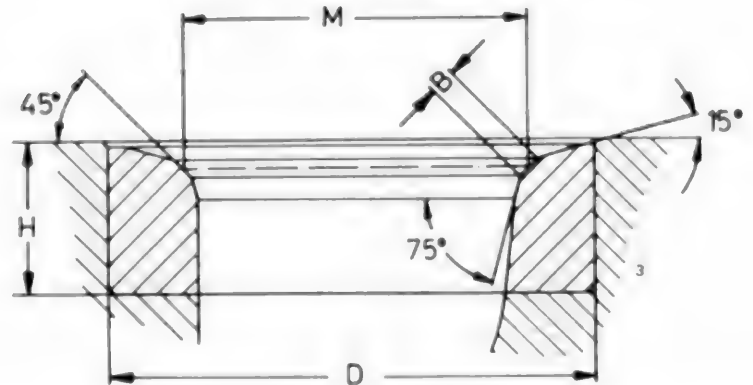
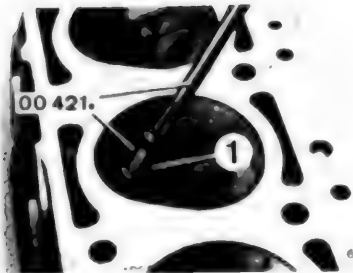


11 12 600 REAMING OUT VALVE GUIDE

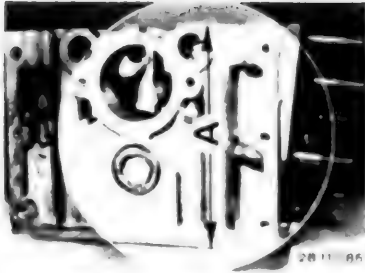
— Valve Removed —

The valve guide must be reamed out and an oversize valve with larger stem diameter "S" = 8.1 or 8.2 mm (0.319 or 0.323") installed when there is excessive play between valve guide and valve stem, see 11 12 595. The valve seat must also be machined in conjunction with this operation — see 11 12 607.

Press guide (1) against the valve seat and ream out the valve guide from the combustion chamber end — turning down the reamer once.

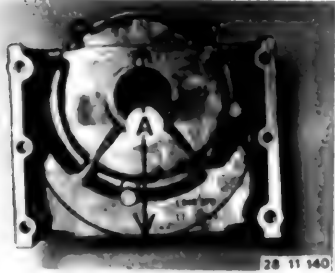


11-355

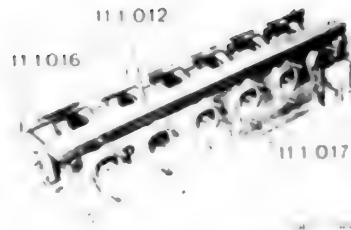


11 12 719 Grinding cylinder head sealing surface
- Cylinder Head disassembled -

The original total cylinder head thickness (A) = 129 ± 0.1 mm (5.079 ± 0.004") may not be reduced by more than 0.3 mm (0.012"). Install a 0.3 mm (0.012") thicker gasket on reground cylinder head - see 11 12 101

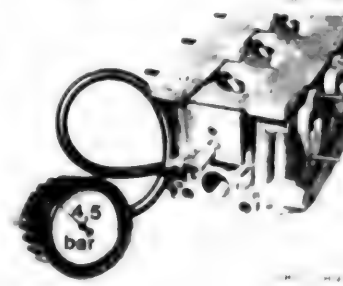


Machine upper timing case cover accordingly after grinding the cylinder head



11 12 729 Checking cylinder head for cracks in water test
- Cylinder head disassembled -

Mount Special Tools 11 1 012 on cylinder head
Close off water circuit on cylinder head with Special Tools 11 1 016 and 11 1 017



Fill cylinder head with compressed air
Testing pressure 4.5 bar (64 psi)
Place cylinder head in a water bath and check for cracks

Note
Water bath can be relaxed with a detergent if necessary

11-356

11 14 100 REMOVING AND INSTALLING/ SEALING UPPER TIMING CASE COVER

Remove cylinder head cover - see 11 12 000
Drain coolant partially if necessary
Unscrew cover (1) on thermostat housing

Installation

Replace seal (2)
Bleed cooling system - see 17 00 039

Unscrew distributor cap (3)
Pull out lead (4)
Unscrew distributor finger (5)
Unscrew adapter (6)
Remove cover (7)

Installation

Check rubber ring (8)
Use a seal on bolt (6)
Tightening torque 23 · 1 Nm (16.5 · 0.5
ft. lbs.)
Install clamp (9)

Unscrew timing case cover

Installation

Tighten bolts (4 and 5) finger tight
Then tighten bolts (6 ... 11) bolts (8 and 9)
are longer
If applicable, replace damaged cylinder head
gasket - see 11 12 101

Important!

Coat holes with Three Bond Silicone 1207**
before mounting the timing case cover

** Source: HWB

11-357

11 14 120 REMOVING AND INSTALLING/ SEALING LOWER TIMING CASE COVER

Remove fan - see 11 52 000
Remove vibration damper with hub - see
11 23 000
Remove upper timing case cover - see
11 14 100
Remove piston for chain tensioner - see
11 31 090
Unscrew pulley on water pump

Unscrew power steering pump
Unscrew bolts (1) - loosen remaining oil pan
bolts

Unscrew timing case cover
Installation
Mount TDC transmitter (6) and suspension
eye (7)
Check length of bolts.

Loosen oil pan gasket on timing case cover
carefully with a knife
If oil pan gasket is damaged, remove oil pan
see 11 13 000

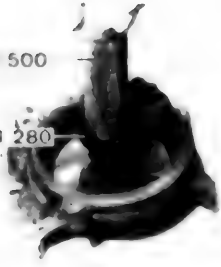
Take off timing case cover
Installation
Coat mating surfaces between oil pan and
crankcase with Three Bond Silicone 1207**
Important!
Holder for tensioning piston must be located
in the oil pocket

** Source HWB

11-358

00 5 500

11 1 280



11 14 131 REPLACING RADIAL OIL SEAL IN UPPER TIMING CASE COVER

Remove upper timing case cover - see
11 14 100
Lift out the radial oil seal.
Drive in new radial oil seal with Special Tools
11 1 280 and 00 5 500
Lubricate sealing lip with oil

27 1 050

11 14 141 REPLACING RADIAL OIL SEAL IN LOWER TIMING CASE COVER

Remove vibration damper with hub - see
11 23 031
Cut off lip of seal and pull off seal with
Special Tool 27 1 050

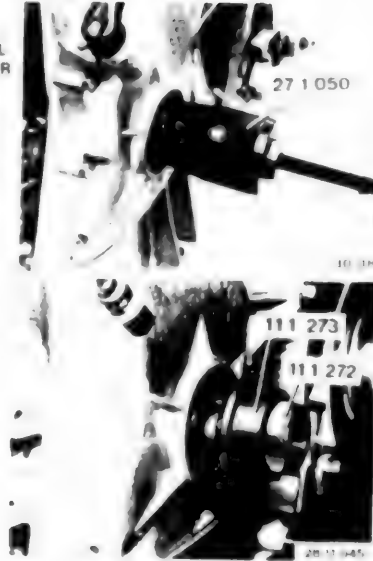
10 124

11 1 273

11 1 272

Lubricate lip of radial oil seal with oil
Drive in radial oil seal with Special Tools
11 1 273 and 11 1 272

20 11 14-85



11-359



11 14 605 REPLACING RADIAL OIL SEAL IN CLUTCH END COVER - Transmission Removed

Remove flywheel - see 11 22 000

Drain engine oil

Loosen oil pan bolts

Loosen gasket in area of end cover/oil pan
joint carefully with a knife

Unscrew end cover

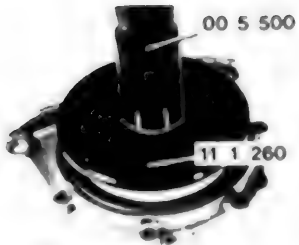
Replace gasket

Remove oil pan - see 11 13 000 - if oil pan
gasket was damaged

Installation:

Coat end cover/oil pan joint with Three Bond
Silicone 1207**

Use Special Tool 11 2 213 to avoid damaging
the radial oil seal



Press in radial oil seal with Special Tools
11 1 260 and 00 5 500

Install new radial oil seal approx. 1 to 2 mm
(0.039 to 0.079") deeper in contradiction
to the standard seal, which had been installed
flush

Lubricate sealing lip with oil

** Source HWB

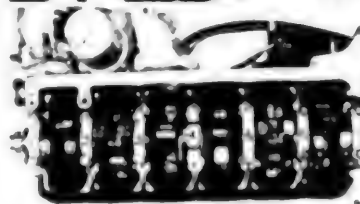
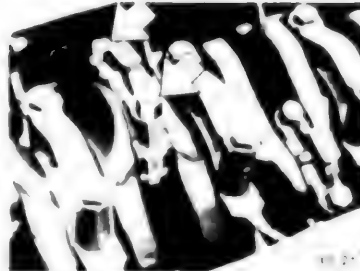
11-360

11 21 000 REMOVING AND INSTALLING CRANKSHAFT

Remove engine - see 11 00 050
 Unscrew bracket of right engine mount
 Mount crankcase in Special Tool 00 1 490
 with help of Special Tool 11 0 120

Remove clutch - see 21 21 000
 Remove cylinder head - see 11 12 100
 Remove timing chain - see 11 31 051
 Remove oil pump - see 11 41 000
 Measure axial play (0.085 to 0.174 mm
 0.0033 to 0.0068") before removing the
 crankshaft
 Check, replace the thrust bearing, if max.
 permissible play is exceeded

Remove flywheel - see 11 22 000
 Unscrew end cover
Installation:
 Replace gasket
 Use Special Tool 11 2 213 to avoid damaging
 the radial oil seal
 Cut off gasket along the oil pan sealing
 surface



Mark conrod bearing caps and corresponding
 connecting rods, and unscrew

Installation:
 Replace conrod bearing shells and measure
 conrod bearing play - see 11 24 571

Unscrew crankshaft bearing caps and lift out
 the crankshaft

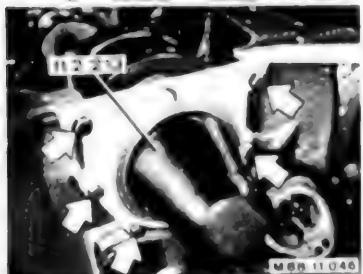
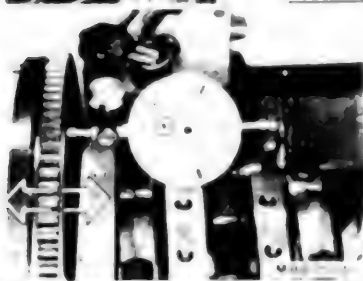
Installation:
 Bearing cap no. 1 is at the sprocket end
 Install bearing shells and check bearing play
 see 11 21 531

Installation:
 Measure axial play after installation of crankshaft

— loosen thrust bearing no. 4 again
 Center the thrust bearing by applying knocks on
 rear and front ends of the crankshaft with a
 plastic hammer

Tighten thrust bearing again as specified
 Measure the axial play (0.085 to 0.174 mm +
 0.0033 to 0.0068")

If the crankcase is replaced, clean oil and water
 bores again thoroughly to remove casting sand



11-361

11 21 501 REPLACING CRANKSHAFT - Crankshaft Removed -

Crankshaft Identification:

Engine	Stroke (mm)	Paint Dot or Code In Center	
M 30 B 30	88	white	L
M 30 B 35	86	blue	K

The crankshaft is surface treated and may only be reground in the factory.

Reground crankshafts are marked with stripes of paint.

Conrod Bearing Journal (A)
1 paint stripe Size 1 *
2 paint stripes Size 1 *

Main Bearing Journal (B)
1 paint stripe Size 1 *
2 paint stripes Size 2 *

Transferring Sprocket
Lift out woodruff key (1)
Pull off sprocket with Special Tool 11 2 000.

Installation
Heat sprocket to max. 200° C (390° F) for installation.

Cars with Manual Transmission:
Install pilot bearing for the transmission main bearing.

Installed Order:
Ball bearing (1), cover (2), felt ring (3) and capsule (4)
Insert cover (2) with the embossment facing out.

* See Specifications

Fill bore in the crankshaft with approx. 1 gram (0.035 oz.) of lubricating grease. Drive in pilot bearing with Special Tools 11 2 030 and 00 5 500.

Replacement crankshafts are supplied only with bearing shells of double classification. The crankshaft is marked with red or blue paint depending on main bearing journal tolerances.

1 = Bearing shell 1-2-3-5-6-7
2 = Bearing shell 4 (pilot bearing)

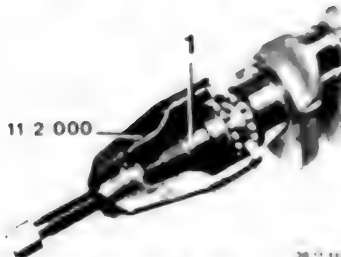
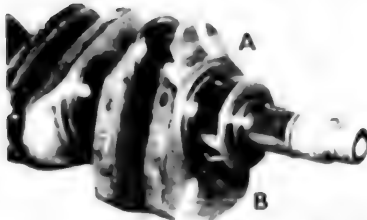
The color code mark is located on the side of a bearing shell.

Check the ground size of main bearing journals.

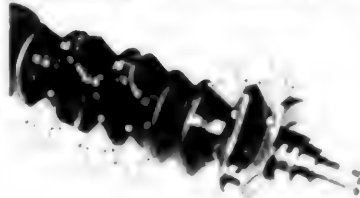
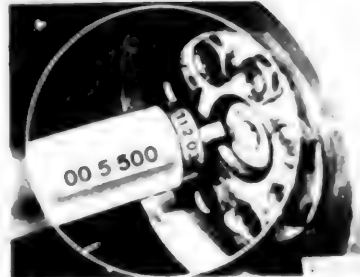
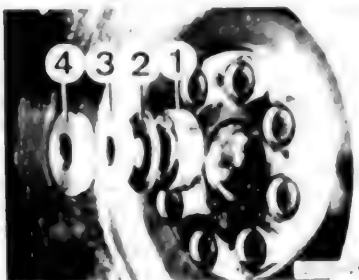
Installing Instructions:
Install only "red" bearing shells in the crankcase (regardless of the old color code mark on the crankcase).
Install "red" or "blue" bearing shells in the bearing caps depending on the color code mark of crankshaft bearing journals.



28 11 240



28 11 132



28 11 308

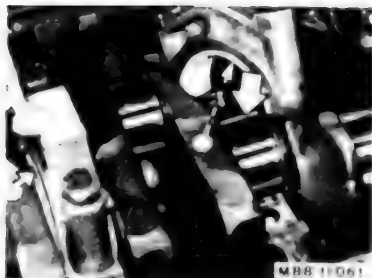


28 11 053



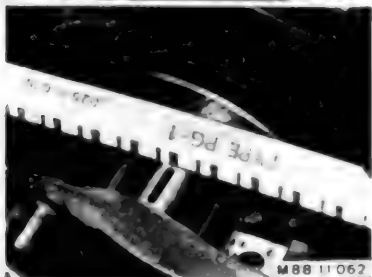
28 11 063

11-361a

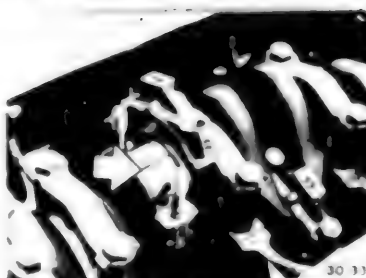


Install crankshaft.
Place Type PG-1 Plastigage on crankshaft wiped clean of oil and tighten the bearing caps with correct torque.*
Do not turn the crankshaft.

Source of Supply for Plastigage:
CARTOOL
Alfred-Brehm-Str. 5
D-8070 Ingoisstadt



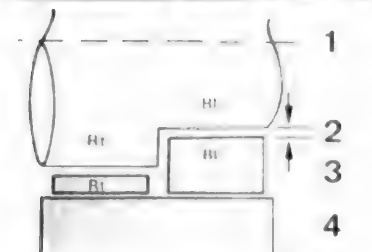
Remove bearing caps.
Read bearing play* by measuring the width of the flattened Plastigage with help of the supplied scale.
Correct the bearing play by installing new bearing shells, bearing shells of a different machined size or with a different color code.



Place Type PG-1 Plastigage on crankshaft wiped clean of oil in the BDC position.
Connecting rods and caps are marked with the same pair number (0 ... 99).
All pair numbers must be on the same side in one engine.
Mount conrod caps.
Tightening torque = 55 ± 3 Nm
(40 : 2 ft. lbs.)

Important:
Do not turn the connecting rods or crankshaft.

Remove bearing caps.
Read bearing play = 0.020 to 0.055 mm (0.0008 to 0.0022") by measuring the width of the flattened Plastigage with help of the supplied scale.
Correct the bearing play by installing new bearing shells, bearing shells of a different machined size or with a different color code.
Replace conrod bolts for final installation and tighten the conrod bearing caps.
Tightening torque = 55 ± 3 Nm
(40 : 2 ft. lbs.)



Survey of Color Code Shaft Diameter
Bearing Shell Thickness*

Double Classification Color Codes:
Rt = red
Bl = blue

- 1 Crankshaft diameter
- 2 Bearing play
- 3 Bearing shell thickness
- 4 Console diameter



Replacing Conrod Bearing Shells:
Red or blue conrod bearing shells are installed standard depending on the pertinent crankshaft ground size.
Install only red bearing shells of a pertinent ground size for replacement crankshafts.

* See Specifications

11-361b

11 21 531 REPLACING CRANKSHAFT MAIN BEARING SHELLS - Engine Disassembled -

The crankshaft is marked with red or blue paint depending on main bearing journal tolerances

Bearing shells have double classification and are marked with red or blue paint

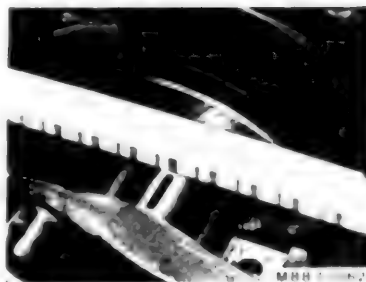
- 1 = Bearing shell 1-2-3-5-6-7
- 2 = Bearing shell 4 (pilot bearing)

Install bearing shells in the crankcase with the same color code as the dot of paint on the console.
Install both bearing shells according to the crankshaft color code mark, if the color code mark on the crankcase has been washed off.
Install bearing shells in the bearing caps with the same color code mark as for the crankshaft

Install crankshaft
Place Type PG-1 Plastigage on crankshaft wiped clean of oil and tighten bearing caps with correct torque*
Do not turn the crankshaft

Source of Supply for Plastigage
CARTOOL
Alfred-Brehm-Str. 5
D-8070 Ingoisstadt

* See Specifications



Remove bearing caps
Read bearing play* by measuring the width of the flattened Plastigage with help of the supplied scale
Correct the bearing play by installing new bearing shells, bearing shells of a different machined size or with a different color code



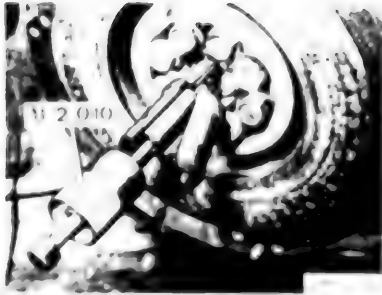
Survey of Color Code Shaft Diameter/
Bearing Shell Thickness*

Double Classification Color Codes
Rt = red
Bl = blue

- 1 Crankshaft diameter
- 2 Bearing play
- 3 Bearing shell thickness
- 4 Console diameter

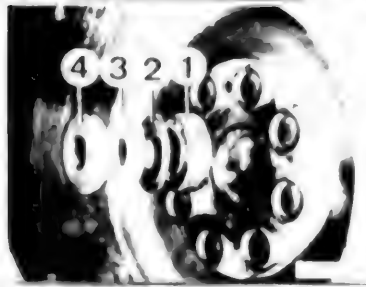
* See Specifications

11-362



11 21 571 REPLACING PILOT BEARING IN CRANKSHAFT

Remove clutch see 21 21 000
Pull out ball bearing with Special Tool
11 2 010
Automatic Transmission
Pull out adapter with Special Tool 11 2 020

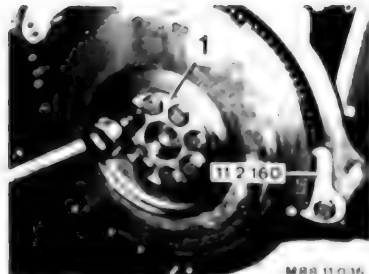


Installed Order
Ball bearing (1)
Cover (2)
Felt ring (3)
Capsule (4)
Install cover (2) with embossment facing out



Pack bore in crankshaft with approx. 1 gram
of lubricating grease
Drive in pilot bearing with Special Tools
11 2 030 and 00 5 500

11-363



M88 11 016

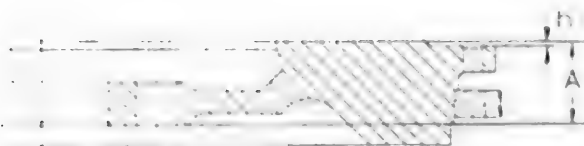
11 22 000 REMOVING AND INSTALLING FLYWHEEL

Remove clutch - see 21 21 000
Hold flywheel with Special Tool 11 2 160
Unscrew bolts and take off flywheel

Clean tapped bores
Use washer (1)
Replace and install new expansion bolts with Loctite No. 270**
Tightening torque = 105 ± 7 Nm
(76 \pm 5 ft lbs)

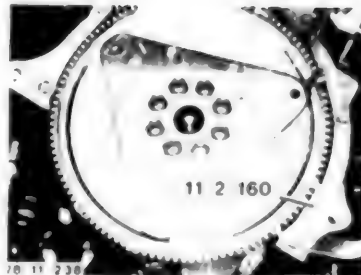
Check flywheel for axial runout*

Friction surface may be machined to minimum thickness A.
If machining the friction surface reduces distance h to zero, the flange surface (distance h) has to be machined.
A = at least 26.6 mm - 0.1 mm (1.031 - 0.004)
The friction surface of a double mass flywheel cannot be machined.



30 61

* See Specifications
** Source of Supply HWB



11 22 051 REPLACING DRIVE PLATE FOR TORQUE CONVERTER

Remove transmission - see Group 24
Hold flywheel with Special Tool 11 2 160
Unscrew bolts and take off flywheel

Clean tapped bores
Replace and install new expansion bolts with Loctite No. 270**
Tightening torque = 105 ± 7 Nm
(76 \pm 5 ft lbs)

11 22 541 REPLACING STARTER GEAR RING

Drill a 6 mm (0.236) dia. hole approximately 8 mm (0.315) deep below a tooth gap in order to make it easier to break the gear ring

Break gear ring at drilled point with a chisel

Installation:
Heat a new starter gear ring to 200 - 230 C (395 to 445 F)
Check temperature with a thermo-color pencil
Tooth bevel faces the engine
Install starter gear ring to fit snug all around with help of a brass mandrel

** Source of Supply HWB

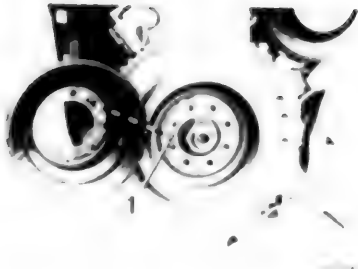
11-364

11 23 010 REPLACING VIBRATION DAMPER

Take off drive belts for alternator, power steering pump and, if applicable, air conditioner compressor.
Unscrew pulley and take off vibration damper

Note:

Centering pin (1) must be in bore of vibration damper.
Tightening torque = 22 ± 2 Nm
(16 ± 1 ft. lbs.)
Tighten drive belts and check tightness with Special Tool 11 5 020



11 23 031 REPLACING VIBRATION DAMPER HUB

Take off drive belts for alternator, power steering pump and, if applicable, air conditioner compressor.
Unscrew pulley

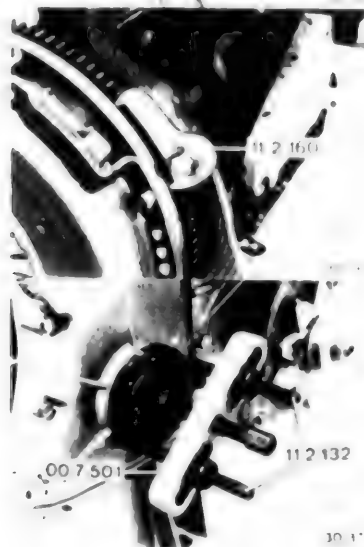
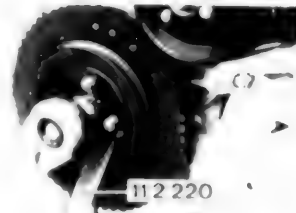
Installation:

Tightening torque = 22 ± 2 Nm
(16 ± 1 ft. lbs.)

Engine Installed in Car
Apply Special Tool 11 2 220 and unscrew nut

Installation:

Tightening torque = 440 ± 10 Nm
(318 ± 7 ft. lbs.)



Engine Removed
Hold flywheel with Special Tool 11 2 160 and unscrew nut.
Take off vibration damper

Note:

One tapped bore is offset 1.
Consequently the hole pattern of the special tool will not fit in certain positions.

Pull hub off of the crankshaft with Special Tools 00 7 501 and 11 2 132

11-365



11 24 521 REPLACING CONNECTING RODS

Pistons Removed

Important!

Only install connecting rods of same weight class in one engine.
Weight class is stamped in machined conrod bearing cap surface.
Connecting rods may not be machined to repair.

Piston pin must slide through conrod bushing under light pressure.
Install conrod bearing shells - see 11 24 571



MAR 11 065



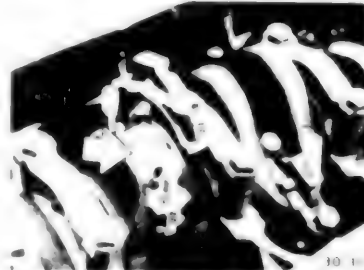
11 24 571 REPLACING CONROD BEARING SHELLS

Engine Disassembled

Install red or blue conrod bearing shells to match color code on connecting rod.

Important!

Check machined size (conrod bearing diameter).



Place Type PG 1 Plastigage on crankshaft wiped clean of oil in BDC position.

Connecting rods and bearing caps are marked with the same pairing code (0 - 99).

All pairing codes must be on the same side in one engine.

Mount conrod bearing caps.

Tightening torque = 55 · 3 Nm (40 · 2 ft. lbs.)

Source for Plastigage:

CARTOOL

Alfred Brehm Str. 5

D-8070 Ingolstadt



Important!

Don't turn connecting rods or crankshaft.
Remove bearing caps.

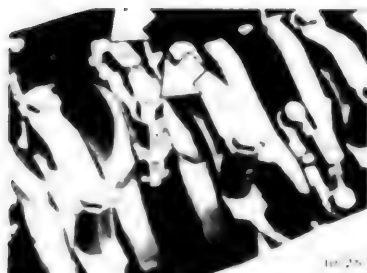
Check bearing play (0.020 to 0.055 mm = 0.0008 to 0.0022") by measuring width of flattened Plastigage with help of the supplied **SCALE**.

Correct the bearing play by installing new bearing shells, bearing shells with different machined size or different color code.

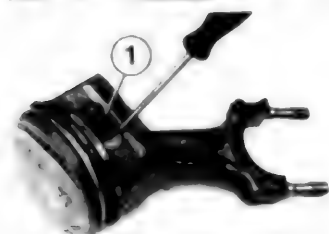
Use new conrod bolts for final installation of the bearing caps.

Tightening torque = 55 · 3 Nm (40 · 2 ft. lbs.)

11-366



10 2 26



30 26

11 25 000 REMOVING AND INSTALLING PISTON

Remove engine and take off cylinder head, oil pan and oil pump.
Unscrew conrod bearing cap and press out piston with connecting rod upwards.
Important!
Mark installed position of connecting rod to crankcase, if conrod bearing shells do not have to be replaced.

Lift out circlip (1)

Press out piston pin

Installation:

Piston pin is matched with piston and must not be mixed up.

Install connecting rod – see 11 24 571

Only install piston of same make and same weight class.

Weight class is stamped with "e" or "m" in piston crown.

Important!

Check machined size (piston diameter)*

Identification

Engine	E	Piston Cup Height mm	Diameter mm
M 30 B 30 M	9.2	2.91	89
M 30 B 30 M Z	9.0	2.26	89
M 30 B 35 M	9.2	1.4	92
M 30 B 35 M Z	9.0	1.4	92



30 2



M 88 11 065

Measure Installed Piston Clearance:
Measure piston diameter at checkpoint "A" with a micrometer.

Engine	Make	Checkpoint A mm (inch)
M 30 B 30 M	Alcan	17.0 (0.669)
	KS	20.8 (0.819)
M 30 B 35 M	Alcan	13.5 (0.531)
	Mahle	22.0 (0.866)

* See Specifications



Set internal calipers to zero on the micrometer with the measured piston diameter.

Measure cylinder bore at bottom, center and top with the internal calipers in driving and rotating directions.

New piston installed clearance: 0.02 to 0.05 mm (0.0008 to 0.0020").

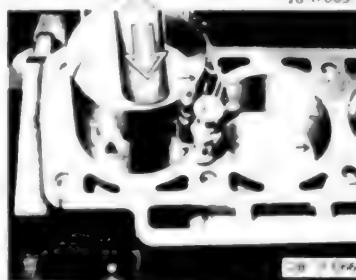
Permissible total wear play: 0.15 mm (0.006").



11 2 260

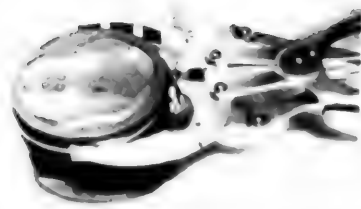
Lubricate piston and piston rings with oil.
Offset piston ring end gaps by 120° to each other.
Compress piston rings with Special Tool 11 2 260.

28 11 065



Insert piston that arrow faces timing chain.

11-367



11 25 651 REPLACING PISTON RINGS OF ONE PISTON - Piston Removed -

Remove piston rings with a piston ring compressing pliers

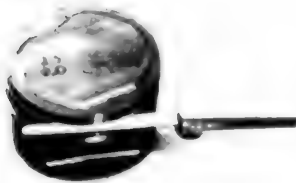
Note

It might not be possible to find the identification on used piston rings
Lay piston rings aside in correct sequence and installed position

Installation

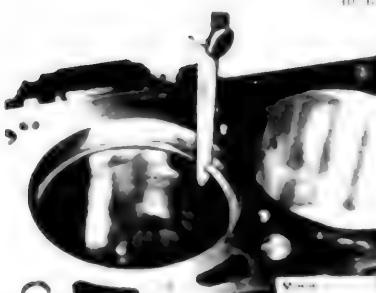
Install piston rings with the word "TOP" facing the piston crown

- 1 Plain compression ring
- 2 Bevelled face compression ring
- 3 Oil scraper ring with rubber lined spring



Measure side clearance

Groove 1	0.040	0.072 mm
Groove 2	0.030	0.062 mm
Groove 3	0.020	0.055 mm



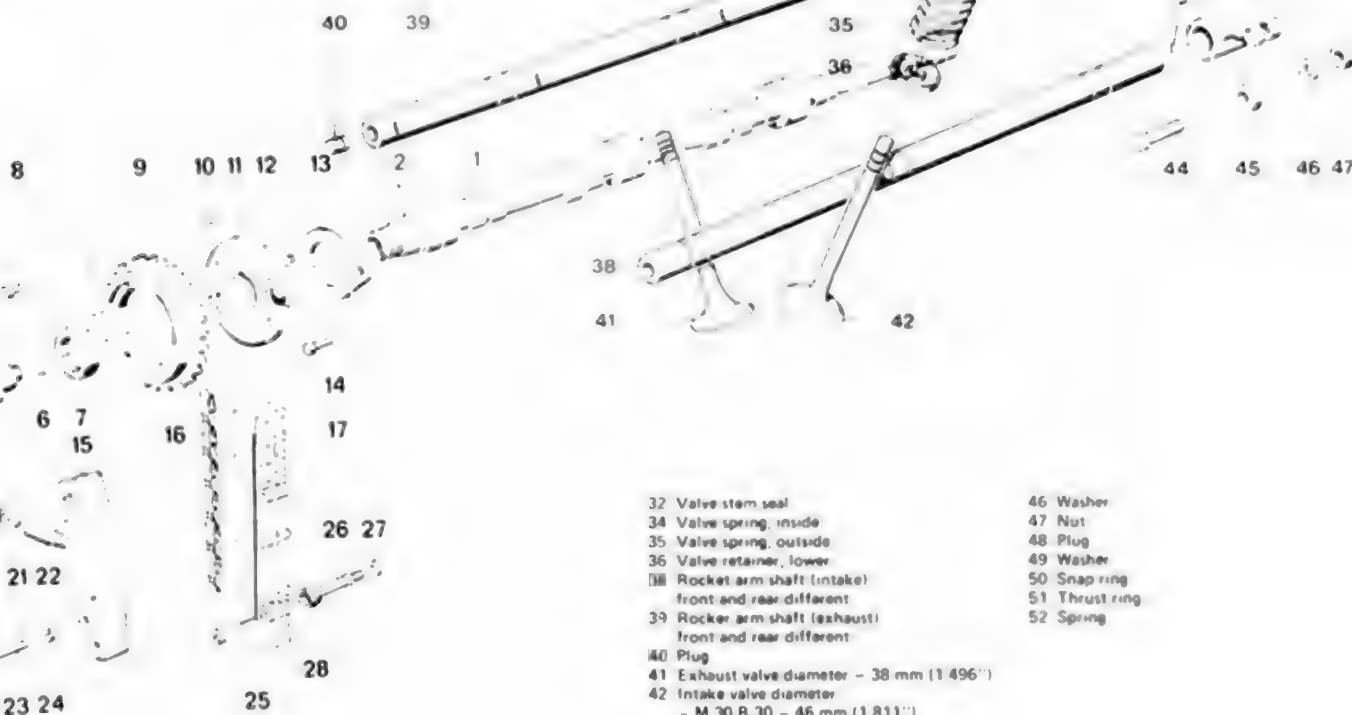
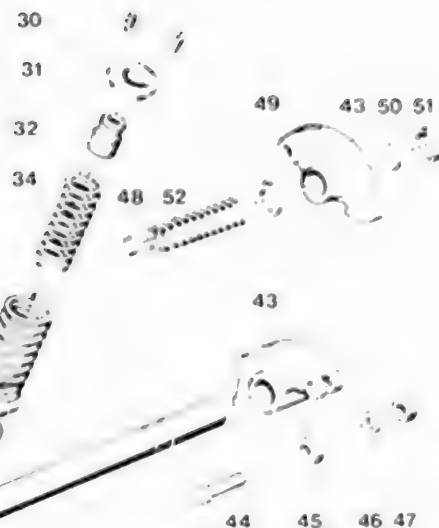
Measure end clearance

Ring 1:	0.20 ... 0.45 mm
Ring 2:	0.40 ... 0.65 mm
Ring 3:	0.30 ... 0.60 mm

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- 1 Camshaft 264°
- 2 Woodruff key
- 3 Bolt
- 4 Seal
- 5 Adapter for distributor rotor
- 6 Dowel pin
- 7 Nut
- 8 Bolt
- 9 Sprocket
- 10 Dowel pin
- 11 Snap ring
- 12 Flange for sprocket
- 13 Guide
- 14 Bolt
- 15 Tensioning rail

- 16 Timing chain
- 17 Guide rail
- 18 Plug
- 19 Seal
- 20 Spring
- 21 Ball
- 22 Piston for chain tensioner
- 23 Shaft bolt for tensioning rail
- 24 Lockwasher
- 25 Lockwasher
- 26 Shaft bolt
- 27 Washer
- 28 Sleeve for oil pump chain tensioner
- 30 Valve collets
- 31 Valve retainer, upper

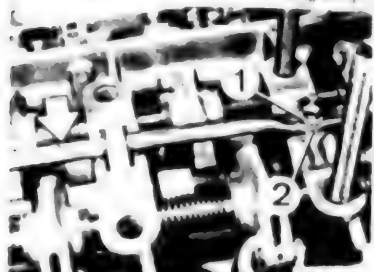
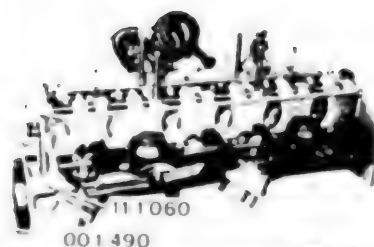


- 32 Valve stem seal
- 34 Valve spring, inside
- 35 Valve spring, outside
- 36 Valve retainer, lower
- 38 Rocket arm shaft (intake) front and rear different
- 39 Rocket arm shaft (exhaust) front and rear different
- 40 Plug
- 41 Exhaust valve diameter - 38 mm (1.496")
- 42 Intake valve diameter - M 30 B 30 - 46 mm (1.811") - M 30 B 35 - 47 mm (1.850")
- 43 Rocker arm
- 44 Bolt
- 45 Eccentric
- 46 Washer
- 47 Nut
- 48 Plug
- 49 Washer
- 50 Snap ring
- 51 Thrust ring
- 52 Spring

11-369

11 31 000 REMOVING AND INSTALLING CAMSHAFT Cylinder Head Removed

Mount Special Tool 11 1 060 on Special Tool 00 1 490
Mount cylinder head on special tool fixture



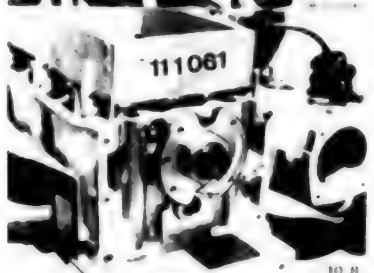
Unscrew oil pipe.

Installation

Use new bolts coated with microencapsulated cement
Replace seals (1 and 2)
Tightening torque
12 - 1 Nm (9 - 0.5 ft. lbs.)

Important:

Arrows on oil pipe face forward

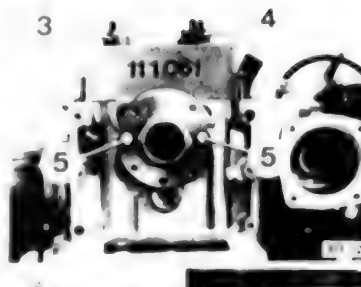


Adjust valve clearance of all valves to the maximum value
Turn camshaft approx. 15° and apply Special Tool 11 1 061

Push rocker arms of cylinders 2 and 4 (intake) forward and align special tool that the tabs bear on the eccentrics of the rocker arms

Important:

To avoid contact between valve heads, first tighten nuts (3) (exhaust) against the stop and then screw in nuts (4) (intake) slightly. Proceed in reverse order when removing the special tool.



Unscrew bolts (5)
Pull out camshaft

Important:

When tightening nuts (4) on the intake side make sure that contact between valve heads is avoided



Installation

It must be possible to turn the camshaft easily after installation of the guide plate. Set valves in cylinder no. 6 to overlap before releasing pressure from the special tool.

Tapped bore in flange must be aligned with the cast boss

Adjust valve clearance - see 11 34 004

11-370

11 31 001 REPLACING CAMSHAFT — Camshaft Removed —

Transfer flange for sprocket
Guide (1), flange (2) and nut (3)
Tightening torque = 142 ± 5 Nm (103 ± 3.5
ft lbs)

Camshaft Identification

Engine	Degrees	Code
M 30 B 30 M	264	K
M 30 B 35 M	264	K

Installation:
Check axial play (0.03 to 0.18 mm / 0.0012
to 0.0071") of camshaft, replacing guide if
necessary

11 31 051 REPLACING TIMING CHAIN

Remove upper timing case cover see 11 14 100
Remove lower timing case cover see 11 14 120
Set cylinder no. 1 to TDC
Unscrew sprocket
Caution!
Never crank engine after removing chain

Installation:
Mount chain that dowel pin (1) is at bottom
left when tapped bores are perpendicular to
the engine - cylinder no. 1 must be at TDC
Tightening torque = 10 ± 1 Nm (7 ± 0.5 ft lbs)

Take timing chain off of the lower sprocket
and guide it out of the guide rail carefully
Note:
Timing chain is pre stretched

11-371

11 31 061 REPLACING SPROCKET SET - Timing Chain Removed -

Remove oil pan - see 11 13 000
Unscrew sprocket (1) on oil pump
Take off chain
Lift out woodruff key (2)

Pull off sprocket with Special Tool 11 2 000

Preparation:
Heat sprocket to max 200 C (390 F) for installation
Tighten oil pump chain - see 11 41 000

11 31 090 REMOVING AND INSTALLING PISTON FOR CHAIN TENSIONER

Unscrew plug (1)

Caution:

Strong spring force

Remove spring and piston

Preparation:

Replace seal (2)

Tightening torque = 35 ± 5 Nm
(25.5 \pm 3.5 ft. lbs.)

Inspection:

Check spring length

Nominal value 155.5 mm (6.122")

Conically wound end of spring faces the plug

Check Piston

Shake to check whether ball (3) moves easily

Blow in air to check valve function

- in direction A = closed

- in direction B = opened

If necessary, drive valve (4) out of sleeve (5) and clean

Are ventilating slots (6) clogged?

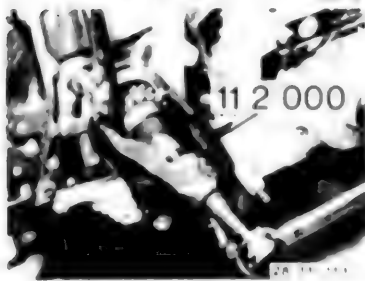
Take off cylinder head cover (see 11 12 000) to bleed the piston.

Remove upper timing case cover - see 11 14 100

Move tensioning rail (6) back and forth for so long after loosening plug (1) until oil runs out of plug (1) and resistance can be noticed

Possible Causes for Unusual Chain Noise

- a) Piston bled incorrectly
- b) Piston seized
- c) Ventilating slots are clogged
- d) Ball valve in piston not working
- e) Spring force excessive or insufficient



11-372

11 31 601 REPLACING TENSIONING RAILS/GUIDE RAIL

Timing Chain Removed -

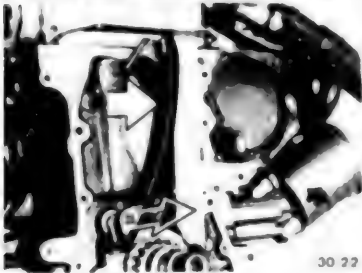
Unscrew water pump (1) and console (2)
Remove lockwashers (3 ... 5)

Installation

Replace gasket for water pump



30 21



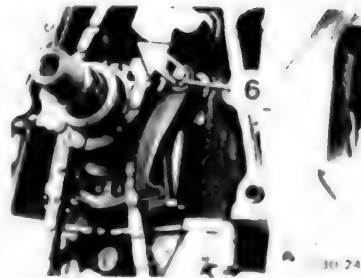
30 22



30 23

Swing in and remove tensioning rail

Pull out guide rail from underneath and
swing aside



30 24

Remove lockwasher (6) and take out tensioning
rail

11-373

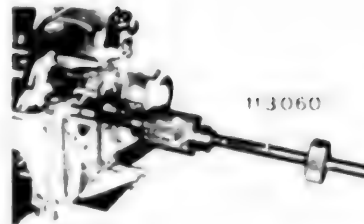
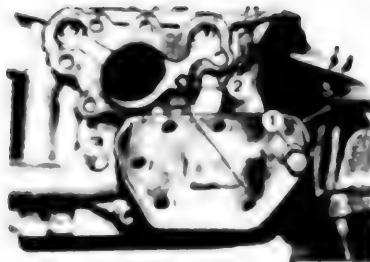
11 33 020 REMOVING AND INSTALLING ROCKER ARM SHAFTS

Remove camshaft - see 11 31 000

Unscrew end cover

Installation

Replace seal (1) and gasket (2)



Screw Special Tool 11 33 060 in the rocker arm shaft

Drive out rocker arm shafts with the impact driver

Caution!

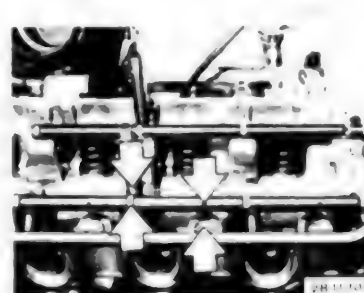
Springs pop out



Push back rocker arms and thrust rings

Lift out snap rings (5)

Remove locating pin (4)



Installation

Longer rocker arm shafts face the chain

Openings face bores for cylinder head bolts

Oil bores face valves

Plug threads face out



Unscrew plugs (3)

Hold possibly turning rocker arm shafts with locating pin (4)

Installation

Screw in plugs (3) with Loctite No. 270**



Installed Order

Spring (9), washer (8), rocker arm (7), thrust ring (6) and snap ring (5)

A = Exhaust

E = Intake

Align rocker arm shafts that cylinder head bolts fit in the openings

Insert locating pins (4)

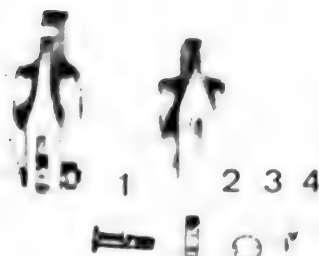
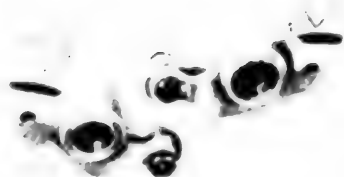
** Source: MWB

11-374

11 33 031 REPLACING ROCKER ARMS

Remove rocker arms - see 11 33 020
 Replace worn rocker arms or rocker arms with loose slides.
 Loose slides will be noticed as excessively loud valve noise.

Transfer bolt (1), eccentric (2), washer (3) and nut (4) to new rocker arm.
 Replace a worn eccentric.
Important!
 Bolt and nut have M 6 x 0.75 fine threads.
 Bore faces out and thick side down.
 Bevelled edge of bolt faces tab on rocker arm.



11 34 004 ADJUSTING VALVE CLEARANCE

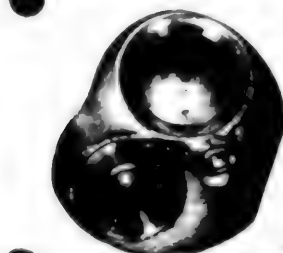
Remove cylinder head cover - see 11 12 000.
 Crank engine with Special Tool 11 3 110.

Order of adjustment is same as the firing order (1 5 3 6 2 4) in compression TDC.
 Adjust valve clearance between the valve and eccentric after loosening nut (1).
 Valve Clearance (Intake and Exhaust)
 Cold 0.30 mm (0.012")
 Operating temperature 0.35 mm (0.014")

Tighten nut (1) with Special Tools 11 1 150 and 00 2 050.
 Tightening torque = 10 ± 1 Nm (7 ± 0.5 ft. lbs.)

11 34 509 CHECKING ALL VALVES FOR LEAKS - Camshaft Removed

Spark plugs remain installed.
 Fill combustion chamber with gasoline outdoors or indoors in conformance with fire prevention regulations.
 If gasoline runs past valve heads, valves and valve seats must be inspected.
 Remove valves - see 11 34 550.
 Machine valve seats - see 11 12 607.



11-375

11 34 550 REMOVING AND INSTALLING VALVES

• Rocker Arm Shafts Removed

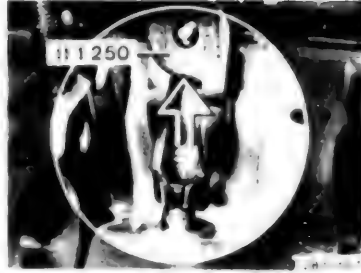
Place Special Tool 11 1 064 (tray) in Special Tool 11 1 060

Press down valve springs with Special Tool 11 1 060 and remove valve collets

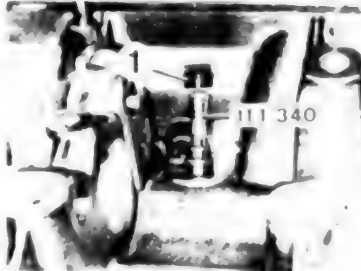
Remove upper spring retainer, double spring set and lower spring retainer.
Take tray out of assembly stand and pull out valve.

Installation

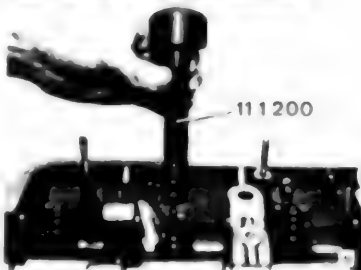
Only install valve springs with same color code, wire gage size and length.
Lubricate valve guide and valve stem with oil.



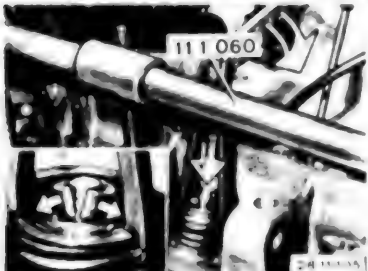
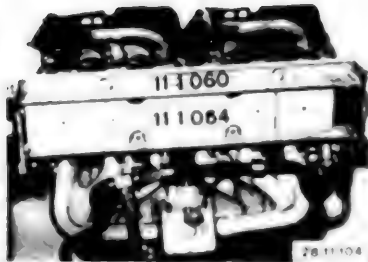
Pull off valve stem seal with Special Tool 11 1 250



Install valve.
Use Special Tool 11 1 340 to avoid damaging the valve stem seal.
Lubricate valve stem seal with oil and install.
Source for Special Tool Sleeves
CARTOOL
Alfred Brehm Str. 5
D-8070 Ingolstadt



The new, improved valve stem seals (inside rifling) are pressed on by hand with Special Tool 11 1 200.
Tool 11 1 200 has two diameters for 7 and 8 mm (0.275 and 0.315") valve stem seals.



11-376

11 40 000 CHECKING ENGINE OIL PRESSURE

Pull off wires on oil pressure switch
Unscrew oil pressure switch (1)

Installation

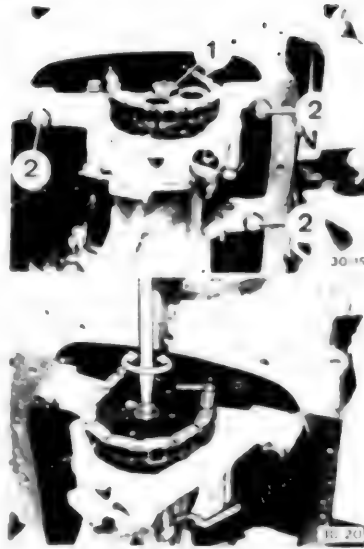
Check gasket (2), replacing if necessary
Tightening torque = 35 ± 5 Nm (25 ± 3.5 ft. lbs.)

Screw in Special Tool 11 4 060

Connect 10 bar (142 psi) pressure tester of BMW Service Tester

Measure oil pressure

At idle speed 0.5 to 2.0 bar (7 to 28 psi)
At max. speed 4.0 to 6.0 bar (57 to 85 psi)



11 41 000 REMOVING AND INSTALLING OIL PUMP

Remove oil pan - see 11 13 000

Unscrew nut (1) and take off sprocket

Unscrew bolts (2)

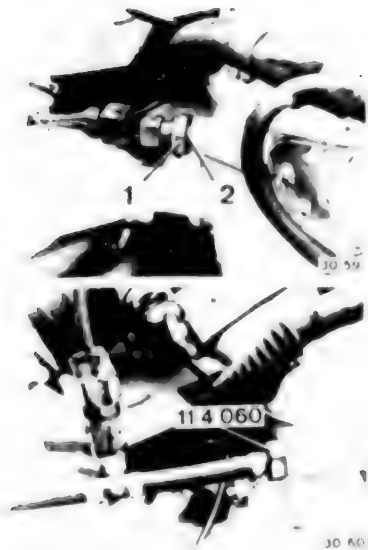
Installation

Tightening torque for bolts (2) = 22 ± 2 Nm (16 ± 1.5 ft. lbs.)

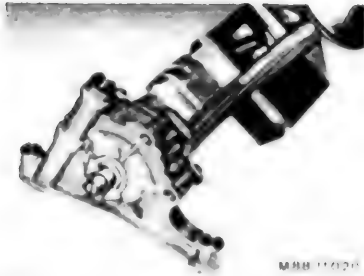
Installation

Slide on sprocket with mounted oil pump

Tightening torque = 27 ± 2 Nm (19.5 ± 1.5 ft. lbs.)

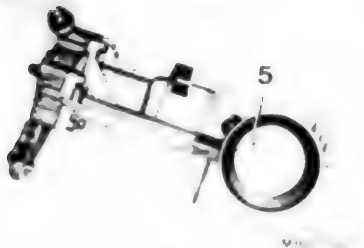


11-377



MHB 11 020

Testing and Servicing:
Check whether oil pump runs easily by turning the drive shaft.



MHB 11 021

Disassemble oil pump and clean oil filter screen (5).



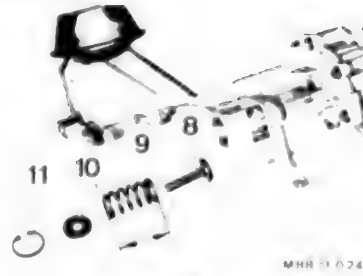
MHB 11 022

Check oil pump for wear
- Scoring in body
- Wear of rotors



MHB 11 023

Pressure safety valve is located in the main bore and regulates the engine oil pressure
- see 11 40 000
Check whether piston (6) moves easily
Check length of spring (7) = 68 mm (2.677")



MHB 11 024

Pressure safety valve (8 bar = 114 psi) regulates the oil pressure in front of the oil filter and prevents oil filter leakage
Check piston seat (8)
Check length of spring (9) = 44 ± 0.4 mm (1.732 ± 0.016")



MHB 11 025

Installation
Press in spring (9) and washer (10) with a wrench socket and install circlip (11)



MHB 11 026

11 41 151 REPLACING OIL PUMP DRIVE CHAIN

Remove oil pan - 11 13 000
Remove timing chain - see 11 31 051
Unscrew nut (1) and take off sprocket
Installation
Tightening torque = 27 ± 2 Nm (19.5 ± 1.5 ft. lbs.)

11-378

11 42 021 REPLACING FULL FLOW OIL FILTER

Unscrew bolt (1)
Replace oil filter (5)

Installation

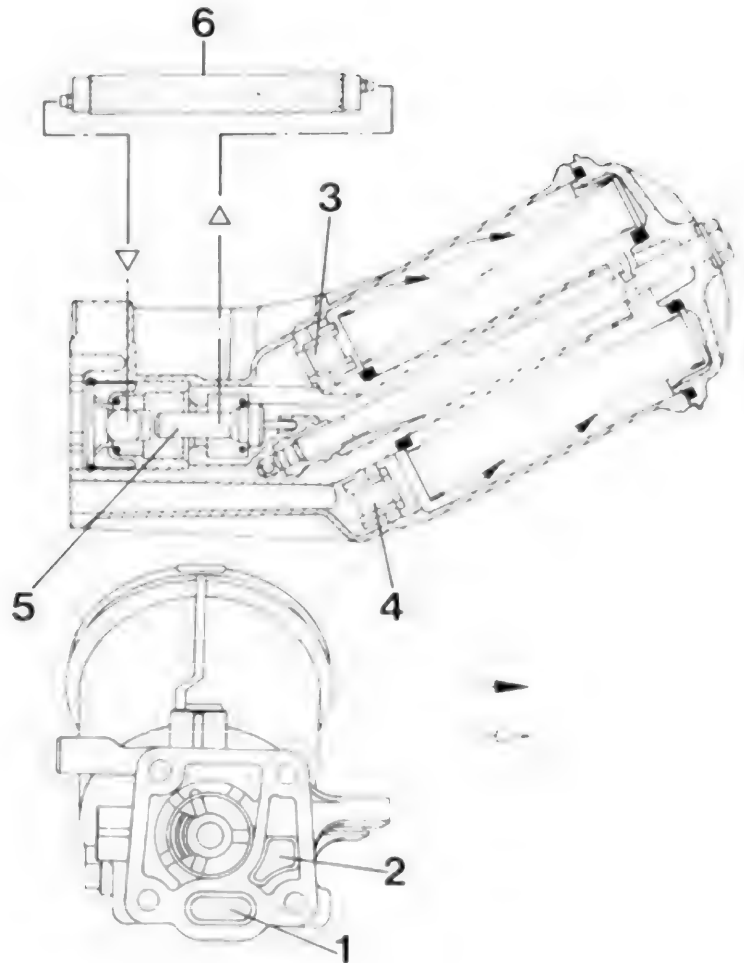
Check seals (2 ... 4), replacing if necessary
Tightening torque : 30 ± 5 Nm (21.5 ± 3.5 ft. lbs.)
Pour in engine oil***

- 1 Feed from oil pump
- 2 Return to main oil bore
- 3 Filter bypass valve – opening pressure
2.2 ± 0.4 bar (31 ± 5 psi)
- 4 Return shutoff valve – opening pressure
0.2 ± 0.08 bar (3 ± 1 psi)
- 5 Thermostatic regulator for switching on
oil cooler
- 6 Oil cooler

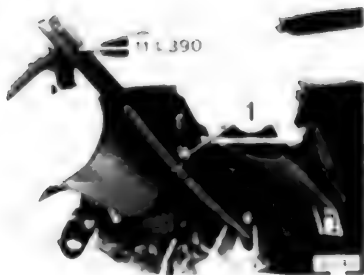
*** See Service Information of Gr. 00



10145



11-379



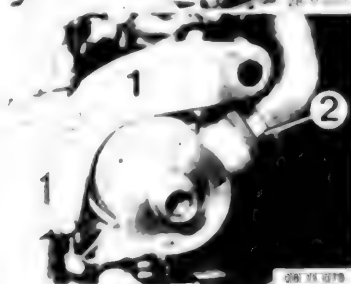
11 43 101 REPLACING GUIDE TUBE FOR OIL DIPSTICK

Loosen clamp (1)
Install guide tube with Loctite No. 270**
and drive in against the stop with Special
Tool 11 1 390

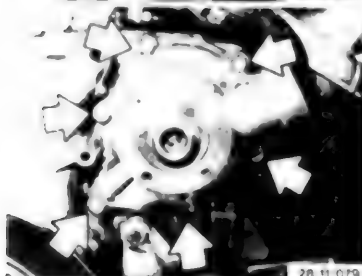


11 51 000 REMOVING AND INSTALLING WATER PUMP

Remove fan - see 11 52 000
Take off drive belt and remove pulley
Installation:
Tighten drive belt and check tightness with
Special Tool 11 5 020



Unscrew suspension eye (1) and disconnect
water hose (2)



Unscrew water pump
Installation:
Replace gasket

** Source: HWB

11-380

11 52 000 REMOVING AND INSTALLING FAN

Hold pulley with Special Tool 11 5 030 and unscrew coupling nut (1)

Important!

Left hand threads turn nut clockwise to unscrew

Tightening torque = 40 ± 10 Nm (29 ± 7 ft lbs)

Installation

Tighten fan with Special Tool 11 5 040
40 Nm (29 ft lbs) tightening torque is equal to 30 Nm (22 ft lbs) setting on torque wrench

11 52 020 REPLACING FAN CLUTCH

Remove fan see 11 52 000

Replace fan clutch when

- a) hub has seized (fan of stopped engine cannot be turned or hard to turn)
- b) fan clutch has axial/radial play or is losing oil

Check switching points* with Vibrocard***

Unscrew fan mounting bolts and take off fan clutch

Installation

Tightening torque = 9 ± 1 Nm (6.5 ± 0.5 ft lbs)

* See Specifications

*** See Workshop Equipment Catalog

11 53 000 REMOVING AND INSTALLING COOLANT THERMOSTAT

Drain coolant partially

Unscrew cover (1)

Installation

Bleed cooling system - see 17 00 039

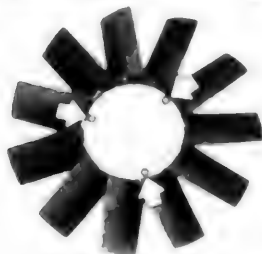
Tightening torque = 9 ± 1 Nm (6.5 ± 0.5 ft lbs)

Remove thermostat

Replace seal (2)

Installation

Bar on thermostat faces out



Testing Thermostat

Does thermostat begin to open at specified temperature?

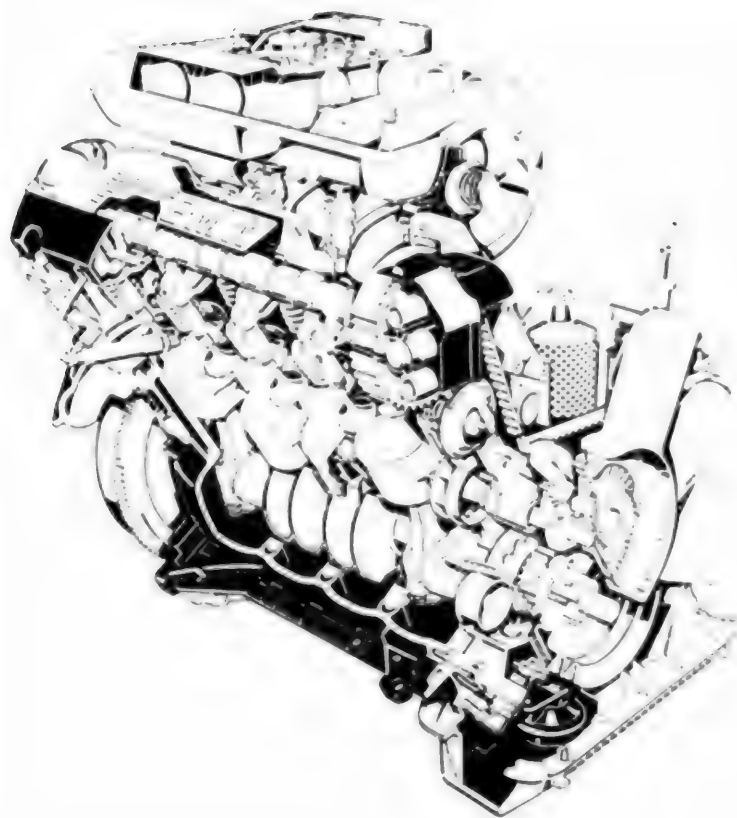
Check by placing thermostat in a hot water bath and comparing actual opening temperature against stamped value

11 Engine M40

	Section drawing view of M40 engine	11- 40 1
11 00 603	Engine – disassemble and assemble (engine removed)	11- 40 2
	General information	11- 40 2
	Engine – mount on assembly stand	11- 40 2
	A. Cylinder head – remove, disassemble and repair	11- 40 2
	Intake manifold – remove	11- 40 2
	Ignition leads distributor – remove	11- 40 3
	Exhaust manifold – remove	11- 40 3
	Drive belt – remove	11- 40 4
	Water pump pulley – remove	11- 40 4
	Vibration damper – remove	11- 40 5
	Thermostat – remove	11- 40 5
	Adapters for heater hoses – remove	11- 40 5
	Toothed belt cover – remove	11- 40 6
	Rocker arms – remove	11- 40 6
	Toothed belt – remove	11- 40 7
	Toothed belt – install and adjust valve timing	11- 40 7
	Cylinder head – remove	11- 40 10
	Cylinder head – mount on assembly stand	11- 40 10
	Camshafts – remove	11- 40 10
	Radial oil seal for camshaft – replace	11- 40 10a
	Valves – remove	11- 40 11
	Valve guide – inspect	11- 40 12
	Valve guide – ream	11- 40 12
	Valve seat – machine	11- 40 12
	Cylinder head sealing surface – inspect, machine	11- 40 13
	Cylinder head – check for cracks in water test	11- 40 13
	B. Engine block crankshaft – disassemble and assemble	
	Orifice for oil supply to hydr. valve clearance compensators – check	11- 40 14
	Alternator – remove	11- 40 14
	Alternator console – remove	11- 40 14
	Oil filter housing – remove	11- 40 14
	Coolant pipe – remove	11- 40 15
	Water pump – remove	11- 40 15
	Clutch flywheel – remove	11- 40 16
	Pilot bearing in crankshaft – replace	11- 40 16
	Oil pan – remove	11- 40 17
	Pistons – remove	11- 40 18
	Connecting rods – remove	11- 40 19
	Connecting rods – check	11- 40 19
	Bushing in conrod end bore – replace	11- 40 19
	Connecting rods – replace	11- 40 19
	Piston rings – replace	11- 40 20
	Conrod bearing shells – replace	11- 40 21
	Rear end cover – remove	11- 40 21
	Front end cover	11- 40 22
	Oil pump – remove, check	11- 40 23
	Crankshaft – remove	11- 40 24
	Main bearing shells – replace	11- 40 24
11 21 501	Crankshaft – replace (crankshaft removed)	11- 40 50

11-40/1

M 40 ENGINE VIEW (Section Drawing)



11-40/2

11 00 603 DISASSEMBLING AND ASSEMBLING ENGINE - Engine Removed -

General Information

An engine (cylinder head) with installed hydraulic valve clearance compensators must not be left upside down longer than 10 minutes.

Hydraulic valve clearance compensators must be transported only in vertical position.

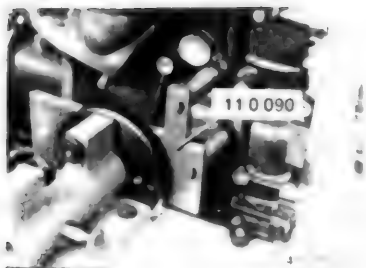
Drained hydraulic valve clearance compensators may not be installed.

After finishing repairs the hydraulic valve clearance compensators or rocker arms must not rattle during the trial run of the engine or the engine must be operated at speeds up to max. 2,000 rpm for so long until the rattling stops.

Disassembling and repairing the engine is described below in chronological sequence. The numbers provided in the list of contents will make it easier to continue after interrupting a repair job or find separate repair points. They only describe the actual removal or installation, but not the entire work scope.

o Mounting Engine on Assembly Stand

Mount engine on Special Tool 00 1 490 using Special Tool 00 1 490



A Removing, Disassembling and Repairing Cylinder Head

o Removing Air Cleaner

Loosen clamp and pull hose off

Pull hose (1) off of cylinder head cover
Loosen clamp and pull hose (2) off of coolant pipe

Pull vacuum hose (1) off
Unscrew locating bolts (2) and nuts (3)
Remove upper manifold section

Installation

Replace gasket.
Graphite surface faces the cylinder head

Tightening torque

Bolts (2) 9 Nm

Nuts (3) 15 Nm

Unscrew nuts and remove lower manifold section

Installation

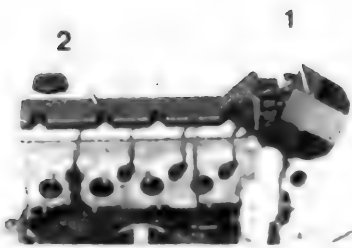
Replace gasket

Tightening torque 13 Nm



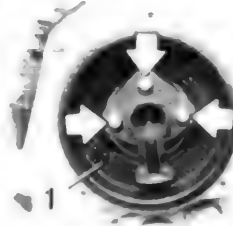
11-40/3

9 99 VK 220



REMOVING IGNITION LEADS DISTRIBUTOR

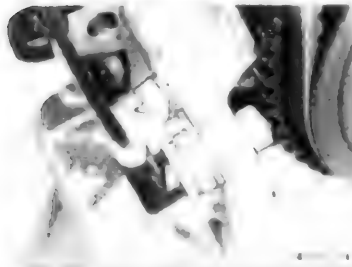
Pull out the lead plugs
Take off cover (1).
Lift out the lead duct (2) with a screwdriver.



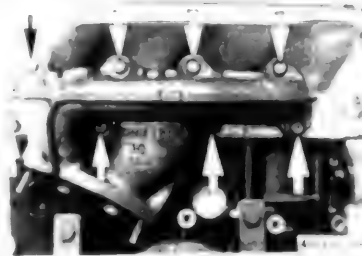
Unscrew screws and take off distributor
finger
Take off cover (1) afterwards
Installation:
Check O-ring on cover, replacing if
necessary



Installation:
Insert ignition leads in guides on insulator
(1) in correct order



Unscrew reference mark sender



REMOVING EXHAUST MANIFOLD

Unscrew nuts and take off exhaust manifold
Installation:
Replace self-locking nuts
Tightening torque = 23 Nm (17 ft. lbs.)



Lift out electric lead duct on face end
Unscrew screws on distributor cap and take
off the ignition tackle

11-40/4

● REMOVING DRIVE BELT:

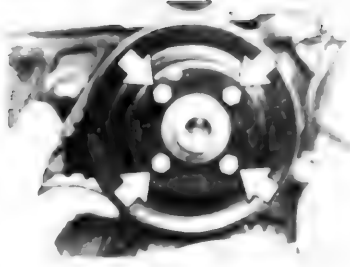
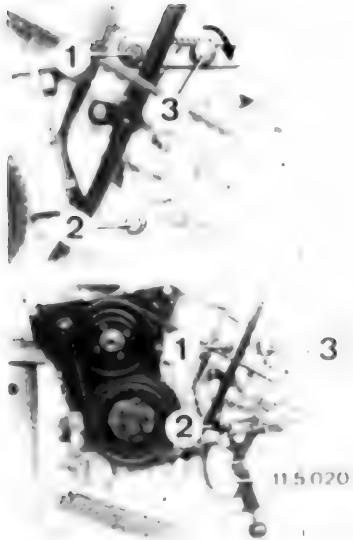
Loosen bolt (1)
Loosen nuts on bolts (2 and 3) and loosen
drive belt by turning bolt (3) in direction of
arrow
Take off drive belt

Installation

Adjust tightness of drive belt with Special
Tool 11 5 020 by turning bolt (3) in
direction of arrow
Tighten nuts on bolts (2 and 3) and bolt (1)

● REMOVING WATER PUMP PULLEY

Counterhold pulley with drive belt and unscrew
bolts



11-40/5

958 VK 2.

● REMOVING VIBRATION DAMPER:

Hold engine with Special Tool 11 2 170

Unscrew bolts on vibration damper and take off vibration damper.

Installation

Align dowel pin bore in vibration damper precisely with dowel pin.

Tightening torque: 23 Nm (17 ft. lbs.)

● REMOVING THERMOSTAT

Unscrew bolts and take off thermostat housing and thermostat.

Installation

Check O ring (1), replacing if necessary.

Install thermostat with O ring facing housing.

● REMOVING CONNECTORS FOR HEATER HOSES

Installation

Clean sealing surfaces and replace gasket.

11-40/6

o Removing Toothed Belt Cover

Unscrew screws and remove lower cover

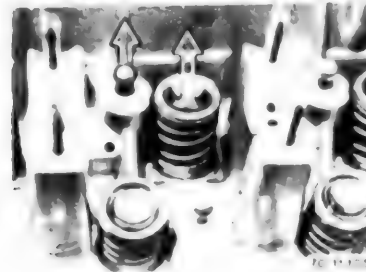
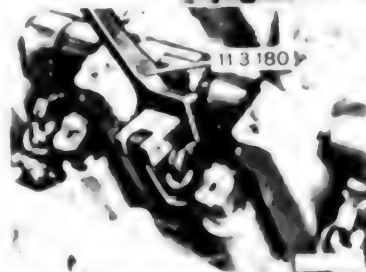
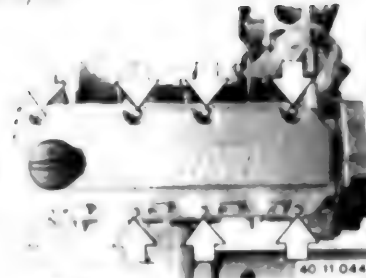
Installation:

Check gasket, replacing if necessary

Unscrew screws and remove upper cover

Installation:

Note dowel sleeves



o Removing Rocker Arms

Unscrew bolts and remove cylinder head cover

Installation:

Check gasket, replacing if necessary
Tighten bolts diagonally from inside to outside

Tightening torque: 9 Nm

Important!

After tightening, retighten the four inner bolts diagonally one more time

Press down on valve with Special Tool 11 31 80 and remove rocker arm

Note:

Have each cam facing up perpendicular to the cylinder head

Special tool must not bear on the cam
Lay rocker arms aside in order and install in the same positions

Remove hydraulic valve clearance compensators and guides

Important!

Keep removed hydraulic valve clearance compensators standing upright to prevent oil from running out

Cover oil return bores to prevent guides from falling into the crankcase

11-40 7

o Removing Toothed Belt

Turn crankshaft to TDC and hold flywheel with Special Tool 11 2 170

Loosen mounting bolt on camshaft sprocket

Remove Special Tool 11 2 170

Loosen nut on tensioning roller and take off toothed belt

Important!
Regardless of the hours of operation a toothed belt must always be replaced each time the tensioning roller is loosened

o Installing Toothed Belt and Adjusting Timing

Hold crankshaft in TDC position with Special Tool 11 2 300

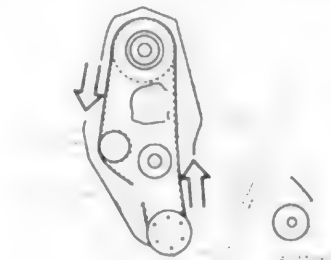
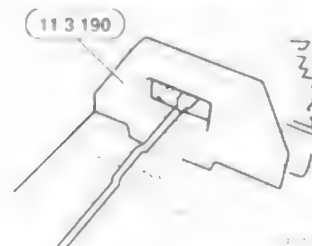
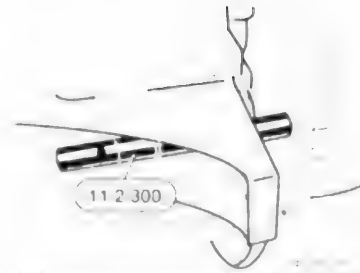
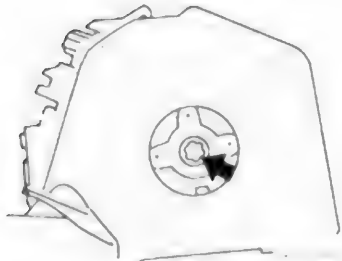
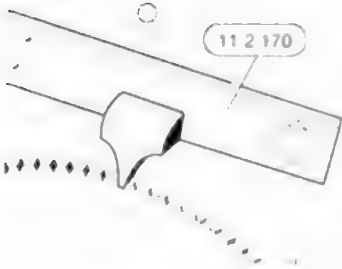
Important!
Remove special tool before operating the engine

Hold camshaft in TDC position (valves of cylinder no. 4 overlap) with Special Tool 11 3 190

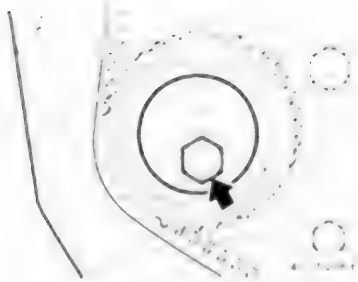
Mount camshaft sprocket with an initial torque of 1 ... 3 Nm (turnable without play) and turn in engine's direction of rotation as far as stop (tab in groove)

Install new toothed belt beginning at the crankshaft sprocket and going via the camshaft sprocket under tension to the tensioning roller.

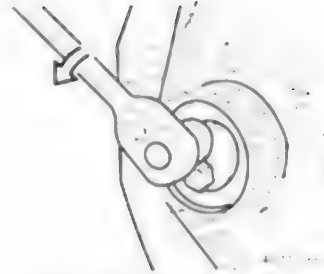
Important!
Position toothed belt on sprockets in the middle.



11-40 8

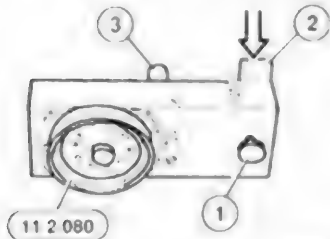


Mount tensioning roller with torque of about 1 Nm that it can be turned easily



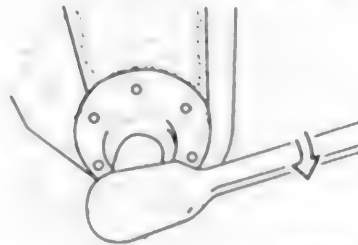
Adjust toothed belt tension to 45 ± 5 scale units by turning the tensioning roller

Tighten tensioning roller with 22 ± 3 Nm and camshaft sprocket with 60 ± 5 Nm torque

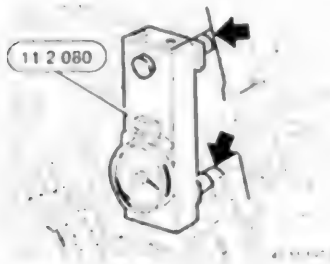


Prepare Special Tool 11 2 080 for the tension test (also refer to operating instructions for 11 2 080)

Pull lockpin (1) up and set bearing pins to maximum size with slide (2)
Set gage needle to "0" and align follow-up needle with gage needle

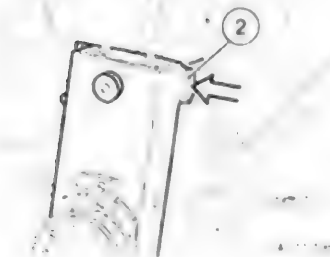


Crank engine on crankshaft at least two full turns in engine's direction of rotation



Apply tester between the camshaft and small intermediate roller in such a manner that both rollers of tester bear on the back of the teeth and the center pin is located in a tooth gap

Hold crankshaft with Special Tool 11 2 300 and camshaft with Special Tool 11 3 190
Loosen camshaft bolt to 1 Nm torque
Apply Special Tool 11 2 080
Loosen tensioning roller bolt and tension toothed belt briefly to 45 ± 5 scale units



Press slide (2) in until engagement of the lockpin is noticed.



Temperature expansion of engine components must be considered for precise belt tension
To measure temperature:
Special Tool 11 5 060

11-40 8a



40 11 013 E

Place temperature sensor at machined cast boss on cylinder head above the coolant outlet and read the temperature.
Afterwards adjust the toothed belt tension precisely to the value given in the temperature-tension graph.

Tighten tensioning roller with 22 ± 3 Nm and camshaft sprocket with 60 ± 5 Nm torque.

Remove holding tools and tester.

Adjusting Table for Readjustments

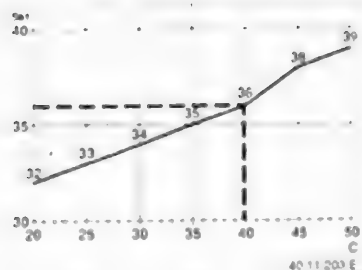
Skt = Scale units on tester

°C = Temperature measured at measuring point on cylinder head

Permissible tolerance ± 2 scale units

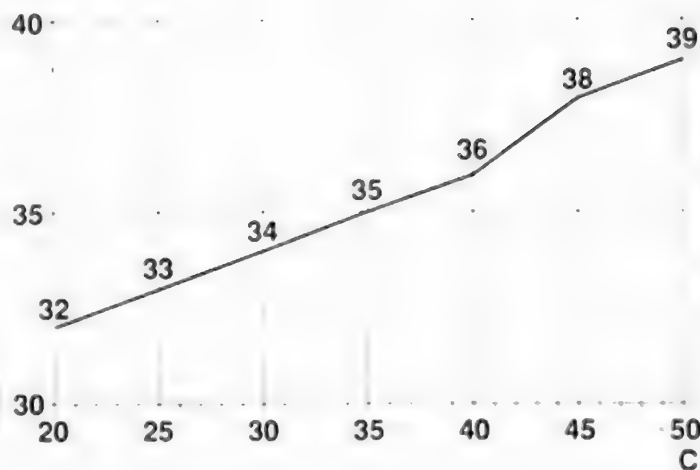
Skt

45



Example
Engine temperature at measuring point
40° C
Adjust toothed belt tension to 36 scale
units on the tester.
Round off values.

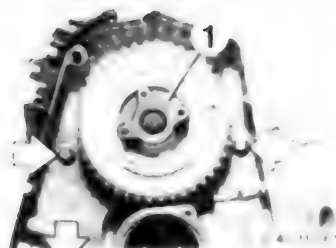
Important!
Toothed belt tension must not be adjusted
if the component (cylinder head) tempera-
ture is less than 20° C.



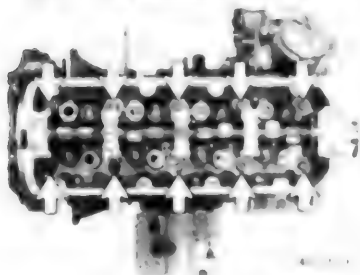
11-40/9

o Removing Cylinder Head:

Unscrew camshaft sprocket (1)
Loosen bolts and take off housing

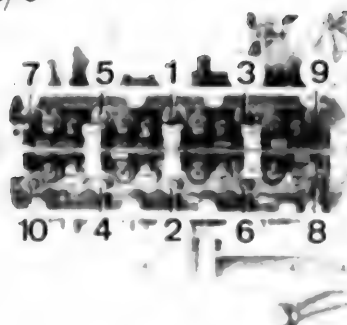
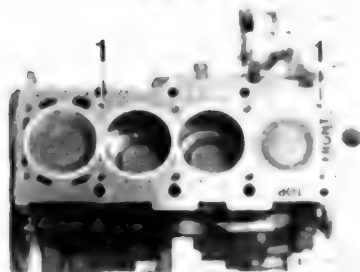


Unscrew cylinder head bolts from outside
to inside and take off cylinder head



Installation

Clean sealing surfaces on cylinder head
and crankcase. If necessary removing re-
mainders of gaskets with gasket remover**
and a hard wood scraper, be careful that
bits of gaskets do not fall into oil bores or
cooling ports
Install new cylinder head gasket with "TOP"
facing up and "FRONT" facing the toothed
belt end.
Check dowel sleeves (1) for damage and
correct installed position



Mount cylinder head and tighten new bolts
(lightly lubricated with oil) in three steps in
the sequence of 1 through 10
Step 1: 33 Nm torque
Step 2: 93° torque angle
Step 3: 93° torque angle

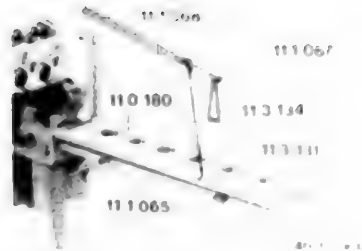
Important!

Cylinder head bolts may only be used
once
Keep oil out of holes in the engine block
(danger of cracking the block, falsified
tightening torque values)



** Source of Supply: MWB

11-40/10



o Mounting Cylinder Head on Assembly Stand Fixture

Mounting Special Tool 11 1 065 on Special Tool 00 1 490

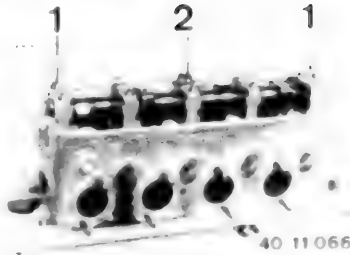
- 11 0 180 = Tray (opening on valve support faces forward)
- 11 1 067 = Guide rod
- 11 1 068 = Thrust lever
- 11 3 131 = Guide bar
- 11 3 134 = Thrust cage

Note

If not already produced, drill 5 mm dia holes (1 and 2) in Special Tool 11 1 068 at distances A = 496 mm and C = 437 mm

- Hole 1 for removal of intake valve
- Hole 2 for removal of exhaust valve

Place cylinder head on assembly fixture that the exhaust end faces forward, align and secure with one cylinder head bolt (front center)

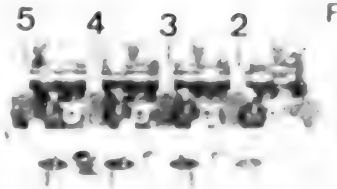


o Removing Camshaft

Loosen bolts (1 and 2) and take off oil pipe

Installation

Replace gasket between hollow connection bolt (2) and pipe
Tightening torque
Bolt (1) = 5.5 Nm
Bolt (2) = 11 Nm

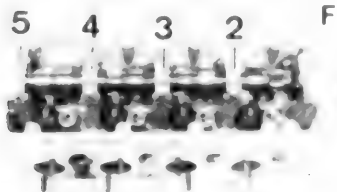


Unscrew and remove camshaft bearing caps (F, 2 - 5) and take out camshaft. Pull old radial oil seal off of camshaft.



Installation

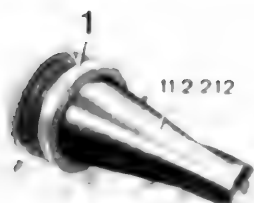
Lubricate camshaft bearings with oil and install camshaft. Apply a thin coat of non-hardening sealing compound** on the bearing surface of bearing cap (F)



Mount bearing caps (F, 2 - 5) in the same position and tighten the bolts. Tightening torque: 11 Nm

** Source of Supply: HWB

11-40/10a



o Replacing Radial Oil Seal for Camshaft

Lubricate sealing lip of new radial oil seal with oil.

Apply Special Tool 11 2 212 on camshaft and push on seal (1) as far as possible.



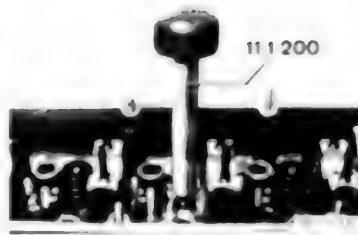
Drive in radial oil seal as far as stop with Special Tool 33 1 190.

11-40/11

9.00 11.22

REMOVING VALVES

Compress valve springs and remove valve collets.
Take off valve springs and spring retainers.
Take tray out of assembly fixture from underneath and remove valves.



Press on valve stem seal by hand against the stop with help of Special Tool 11 1 200.

Pull off valve stem seal with Special Tool 11 1 250.



Installed Order:

- 1 = Valve
- 2 = Inner spring retainer
- 3 = Valve stem seal
- 4 = Outer spring retainer
- 5 = Inner spring
- 6 = Outer spring
- 7 = Upper spring retainer
- 8 = Valve collets

Installation

Lubricate valve stem with oil and insert valve.
Use a new valve stem seal.
Always use Special Tool 11 1 380 to avoid damaging the seal.
Lubricate seal (1) with oil and mount.



Important Scrapping Information:

Exhaust valves are filled with sodium to improve carrying off heat.

Sodium filled valves may not be scrapped as normal parts without special treatment.
The reason for this is that sodium could explode when melted.
It is also not approved to use them as "special tools" (for example: driving mandrels, etc.), which is common practice in some workshops!

Consequently sodium filled exhaust valves must be collected for scrapping and sent to the Landshut Factory, HT-L-2, for neutralization.

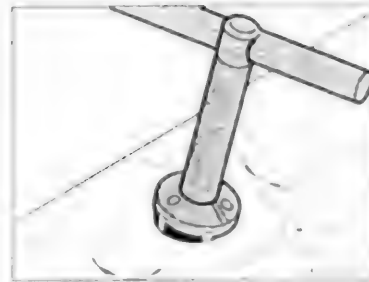
See Service Information of Group 11 for scrapping in countries, where it is absolutely impossible to return used valves or when they are not obligated to return parts.

11-40/12



• Machining Valve Guide and Seat

To measure, insert a new valve in such a manner that the valve stem end is flush with the valve guide.
Apply dial gage and measure tilt.
Max. permissible tilt*



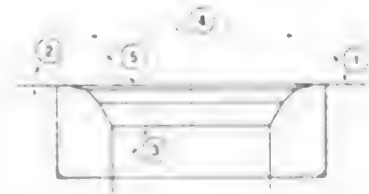
• Machining Valve Seat

Machine the valve seat to instructions of the tool supplier using Special Tool 00 3 520 or 00 3 580.
Dimensions and angles*

Correction cutter from Neway

• Reaming Valve Guides

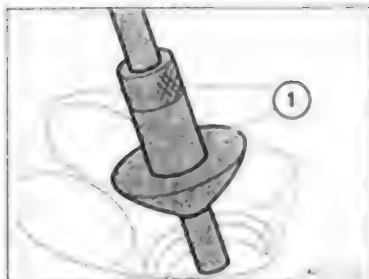
In case of excessive play between the valve stem and valve guide, the valve guide must be reamed out and a repair valve with oversized stem diameter* installed.



After Machining Valve Seat Surface:
Machine valve seat outside and inside diameters to specified size using a correction cutter* in such a manner that the specified valve seat width* is produced.

- 1 Valve seat angle
- 2 Outside dia. correction angle
- 3 Inside dia. correction angle
- 4 Valve seat outside diameter
- 5 Seat width

Valve seat dimensions*



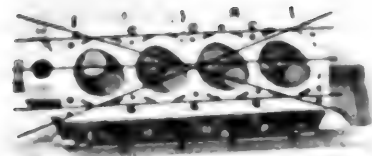
Assemble Special Tool 00 3 200 depending on the stem diameter.
Press mushroom guide (1) against the valve seat and ream out the valve guide dry from the combustion chamber end.
Turn down the reamer once.

* Refer to Specifications

* Refer to Specifications

11-40/13

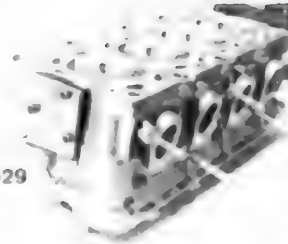
9.00.15.2



● CHECKING/MACHINING CYLINDER HEAD SEALING SURFACE:

Check levelness of cylinder head sealing surface with a standard steel ruler.
Max. deviation in levelness: 0.03 mm (0.0012").

11 1 029



● CHECKING CYLINDER HEAD FOR CRACKS IN WATER TEST - Cylinder Head Disassembled

Mount Special Tool 11 1 029

Note

Leave the temperature sensor/sensor installed

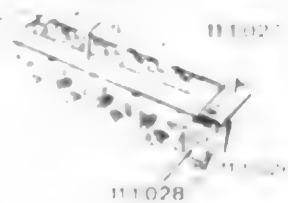
Remove all attachments on cylinder head to machine the sealing surface

Max. machining: 0.3 ± 0.05 mm (0.012 ± 0.002")

New cyl. head height: 141.0 mm (5.551")

Machining limit: 140.55 mm (5.533")

11 1 021

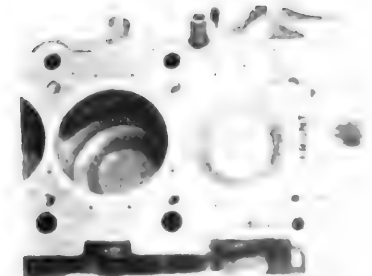


11 1 027

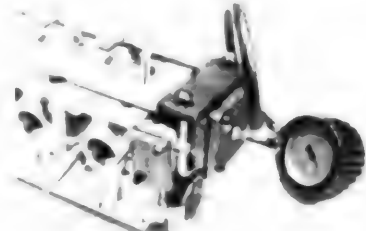
Mount Special Tools 11 1 021 with cylinder head bolts

Mount Special Tools 11 1 026 / 027 / 028

11 1 028



A 0.3 mm (0.012") thicker cylinder head gasket, which must be installed together with an appropriately thicker O ring for the coolant duct, is available for 0.3 mm (0.012") machining



Fill cylinder head with compressed air (testing pressure: 4.5 bar / 64 psi)

If pressure drops, place cylinder head in water bath and check for cracks.

Note

If necessary, relax water bath with a detergent

11-40/14

B DISASSEMBLING AND REPAIRING ENGINE BLOCK CRANKSHAFT DRIVE

g Checking Orifice for Oil Supply to Hydr. Valve Clearance Compensators

Screw orifice out of engine block and
check that its bore is not clogged, cleaning
the bore if necessary.

Important:

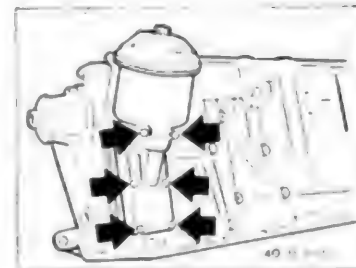
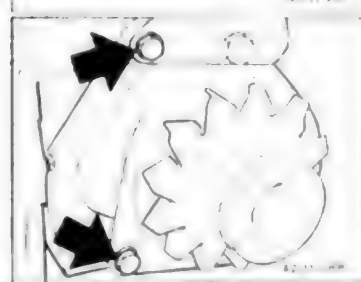
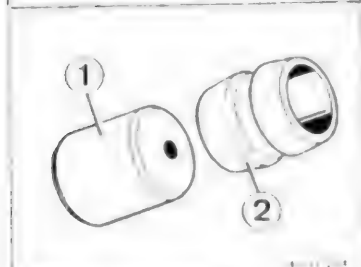
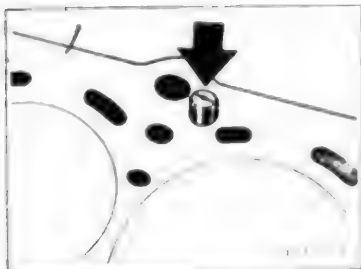
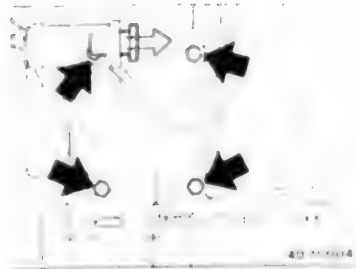
A reduction jet (1) with rubber-lined spacing
sleeve (2) for oil supply to the cylinder head
is installed in the engine block of M 40 en-
gines since 9/92.

h Removing Alternator

Unscrew bolts and remove alternator.

g Removing Alternator Console

Press out sleeve (1).
Unscrew bolts and remove console.



h Removing Oil Filter Housing

Unscrew bolts and remove oil filter housing.

Installation:
Check seals, replacing them if necessary.

● REMOVING COOLANT PIPE

Unscrew bolts and pull coolant pipe out of engine block
Installation
 Replace and lubricate O-ring with a lubricant**



● REMOVING WATER PUMP

Unscrew bolts

Screw two bolts in threads (1) and press off the water pump uniformly
Installation
 Replace O-ring and coat with lubricant**
 Tightening torque: 9 Nm (6.5 ft. lbs.)



** Source: HWB

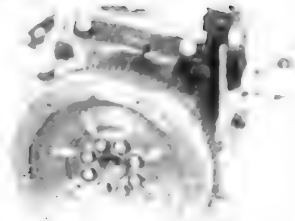
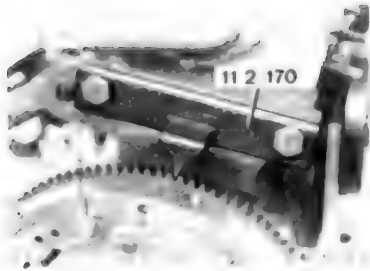
** Source: HWB

11-40/16

9.88 WK 220

● REMOVING CLUTCH / FLYWHEEL

Hold flywheel with Special Tool 11 2 170



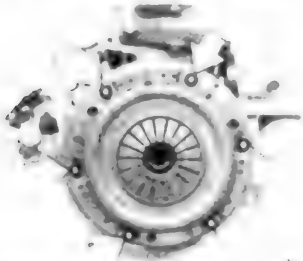
Unscrew bolts and take off flywheel

Installation

Clean threads and install bolts with a bolt cement**

Tightening torque: 105 Nm (76 ft. lbs.)

Unscrew bolts uniformly
Take off pressure plate and drive plate



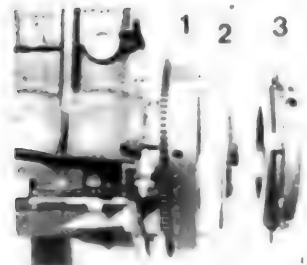
Installation

1 = Flywheel

2 = Drive plate

3 = Pressure plate

Install drive plate (2) with flat end facing flywheel (1)

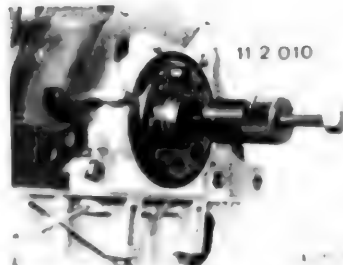


Center drive plate with Special Tool 21 2 100 and tighten bolts
Tightening torque: 23 Nm (17 ft. lbs.)



● REPLACING PILOT BEARING IN CRANKSHAFT

Remove pilot bearing with Special Tool 11 2 010



Installation

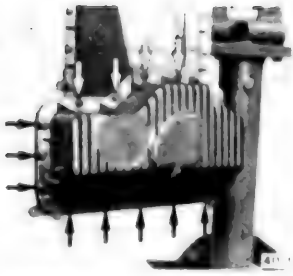
Insert pilot bearing and drive it in against the stop with Special Tool 11 2 030



** Source: HWB

11- 40/17

0 89 58 220



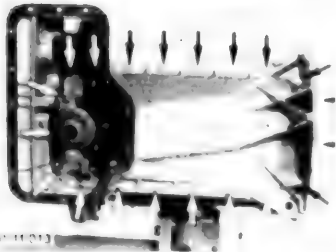
REMOVING OIL PAN

Unscrew bolts and take off lower oil pan section

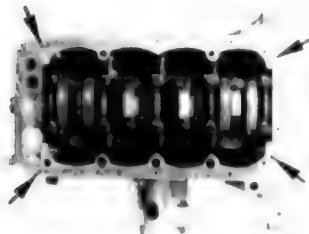
Installation:

Replace gasket

Tightening torque = 9 Nm (6.5 ft. lbs.)



Unscrew bolts and take off oil pan



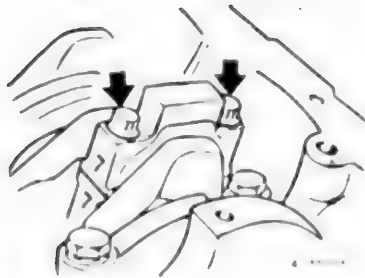
Installation:

Replace gasket

Fill out oil pan gasket on joints between front or rear end covers and crankcase with a non-hardening sealant**

Tightening torque = 9 Nm (6.5 ft. lbs.)

** Source of Supply HWB



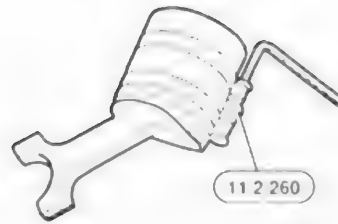
6 Removing Piston

Unscrew conrod bearing cap
Remove piston

Important

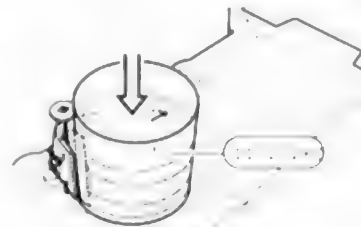
Mark position of connecting rod to crankshaft, if the bearing shells do not have to be replaced
Connecting rods and caps are marked with the same pair numbers (1-99) and must not be mixed up

Mark piston and reinstall it at the same position, if the piston does not have to be replaced



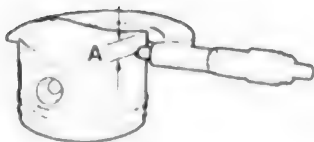
Installation

Lubricate piston and piston rings lightly with oil
Align gaps of piston rings (offset approx 120°, but not above the piston pin eye)
Compress piston rings using Special Tool 11 2 260
Apply Special Tool 11 2 470 on connecting rod



Important

Insert piston that arrow points to camshaft drive
Guide crankshaft journal and connecting rod together
Compressing tool must bear flat on crankcase all around
Press in piston with light knocks (e.g. from handle of a hammer)



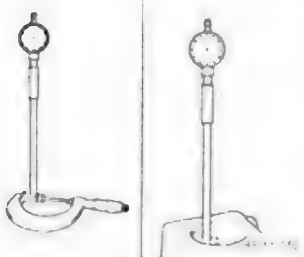
Installation

Measure the piston installed clearance before installing
Measure the piston diameter at distance A* from the bottom edge of the piston using a micrometer



Installation

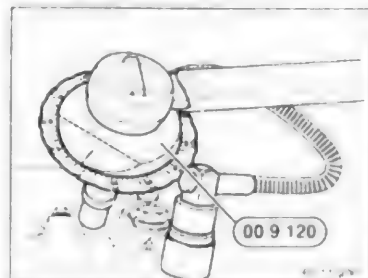
Lubricate conrod bearing shells with oil
Mount bearing cap that pair numbers are aligned
Use new conrod bolts



Set internal caliper to zero on micrometer with the measured piston diameter
Measure cylinder bore at bottom, middle and top diagonally

New piston installed clearance*
Max. permissible total wear clearance*

* Refer to Specifications



Installation

Tighten conrod bolts use Special Tool 00 9 120 or Special Tool 11 2 110

Conrod bearing cap bolt tightening torque*

* Refer to Specifications

11-40/19



a Removing Connecting Rods

Lift out circlip and press out piston pin

Important!

Pistons and piston pins are matched and must not be mixed up. Insert circlip that its opening is opposite the hole.

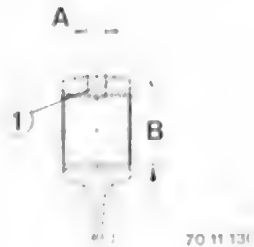
Note:

Install connecting rod that the pair number is opposite that piston's arrow for installed direction.



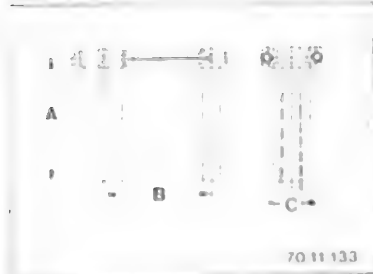
e Replacing Bush in Conrod

Press out old bush with a suitable mandrel. Press in new bush. Bush gap may be positioned optionally at point A or B.



Drill oil bore (1)

Distance A = 6 mm diameter. Deburr edges of bore at sliding surface of bush. Ream bush open to diameter B = 22 005 22 010 mm.



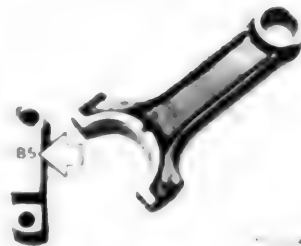
e Checking Connecting Rods

Check connecting rod for deviation from parallel and distortion.

- A Testing distance = 150 mm
- B Max. permissible parallel deviation in testing distance = 0.04 mm
- C Max. permissible distortion to either side = 0° 30'

Checking Bush in Conrod

Press-fit between the bush and piston pin is correct, if the piston pin can be pressed through the bush by hand with only slight force and there is no noticeable play.



e Replacing Connecting Rods

Only connecting rods of the same weight class (die-stamped on bearing caps) may be installed in one engine.

Note:

Therefore only sets of connecting rods are available from Parts.

11-40/20

6 Replacing Piston Rings of One Piston

Remove piston rings with a piston ring compressing pliers.

Note

It might not be possible to find the identification on used piston rings. Lay piston rings aside in correct sequence and installed position.

Measure side clearance

Groove 1	0.020	0.052 mm
Groove 2	0.020	0.052 mm
Groove 3	0.020	0.055 mm

Installation

Install piston rings with the word "TOP" facing the piston crown.

- 1 Plain compression ring
- 2 Bevelled face compression ring
- 3 Oil scraper ring with rubber lined spring

Offset piston ring end gaps by about 120° to each other, but not above piston pin bores.

Measure end clearance

Specifications

Ring 1:	0.20	0.40 mm
Ring 2	0.20	0.40 mm
Ring 3	0.20	0.45 mm

11-40/21

● REPLACING CONNECTING ROD BEARING SHELLS

Select new bearing shells according to paint mark on connecting rod
Important!
 Check ground size of crankshaft also refer to Replacing Main Bearing Shells)

Installation

Check conrod bearing play
 Place Plastigage Type PG 1 on crankshaft
 wiped clean of oil in BDC position
 Mount conrod bearing caps and tighten with the old conrod bolts to specified torque

Important!

Do not turn the connecting rods or crankshaft
 Remove bearing caps and read bearing play (nominal: 0.020 to 0.055 mm - 0.0008 to 0.0022") by measuring width of flattened Plastigage with help of supplied scale
 Correct bearing play by installing new or bearing shells with a different paint mark

● REMOVING REAR END COVER

Unscrew bolts and take off cover

Installation

Lift out radial oil seal and drive in new seal with Special Tool 11 1 260

Apply Special Tool 11 2 213 on crankshaft

— Replace gasket for cover
 — Lubricate sealing lip of radial oil seal with oil
 Slide on and tighten cover

Tightening torque: M 6 - 9 Nm (6.5 ft. lbs.)
 M 8 - 22 Nm (16 ft. lbs.)

11-40/22

998 VK 2.0

REMOVING FRONT END COVER

Unscrew tensioning roller (1), drive gear (2) and stabilizing roller (3)

Installation

Align drive gear (2) with groove facing the woodruff key and push on crankshaft.
Mount washer (3) with shoulder against the drive gear and tighten bolt (4).
Tightening torque = 310 Nm (224 ft lbs).
Screw on nut for tensioning roller only loosely.

Lift out woodruff key (1) and pull off ring (2).

Unscrew all mounting bolts of end cover and take off cover.

Installation

Replace O-ring on crankshaft.
Replace cover gasket.
Mount end cover.
Tightening torque:
M 6 = 9 Nm (6.5 ft lbs)
M 8 = 22 Nm (16 ft lbs).
Drive in new radial oil seal against stop with Special Tool 11 2 320.
Lubricate sealing lip of radial oil seal with oil.

11-40/23

● REMOVING/CHECKING OIL PUMP

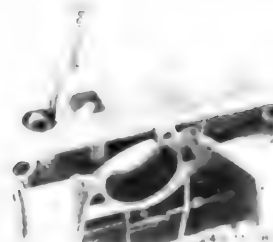
Unscrew bolts and take off cover

Installation

Tightening torque: 9 Nm (6.5 ft. lbs.)



Lift out circlip and remove pressure valve



Measure play between pump body / outer rotor and outer rotor / inner rotor
Nominal value = 0.12 to 0.20 mm (0.005 to 0.008").

Note

Reinstall rotors in the same position (inner rotor with guide facing the body)



Installation

1 = Piston

2 = Spring

3 = Sleeve

4 = Circlip

Measure length of unloaded spring (2)
Nominal value = 84.1 mm (3.311").

11-40/24

REMOVING CRANKSHAFT (Replace crankshaft - see 11 21 501)

Remove main bearing caps (1 ... 5) and lift out crankshaft.

Installation

Bearing caps (1 ... 3) are marked with die-stamped numbers.
Bearing cap (4) has a shoulder on the side of the cap and bearing cap (5) is not marked.

Lubricate bearing shells with oil.
Install crankshaft.
Mount bearing caps (1 ... 5) with bearing cap no. 1 on the camshaft drive end in such a manner that all bearing shell grooves are on one side.
Align bearing caps precisely.

Tighten bolts (washed and lubricated with oil) in two steps.

Step 1 23 Nm (17 ft. lbs.)
Step 2 50° torque angle

REPLACING MAIN BEARING SHELLS:

The crankshaft is marked with yellow, green or white paint depending on main bearing journal tolerances.

Important

Check ground size* of the crankshaft!

Conrod Bearing Journal (A)

1 paint stripe Size 1 (0.25 mm)
2 paint stripes Size 2 (0.50 mm)

Main Bearing Journal (B)

1 paint stripe Size 1 (0.25 mm)
2 paint stripes Size 2 (0.50 mm)

The bearing shells are marked with yellow, green or white paint

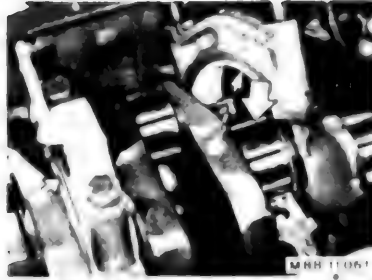
- 1 Bearing shell 1-2-3-4 (only caps)-5
- 2 Bearing shell 4 (thrust bearing, only crankshaft)

Check the ground size of main bearing journals!

Install bearing shells in the crankcase with the same color code mark as the dot of paint on the console.
Install both bearing shells according to the crankshaft color code mark, if the color code mark of the crankcase has been washed off.
Install bearing shells in bearing caps with the same color code mark as for the crankshaft.

* See Specifications

11-40/24a

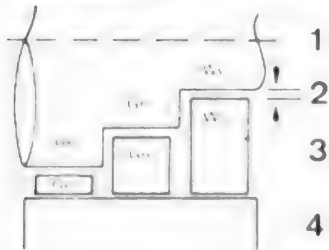


Install crankshaft
Place Type PG-1 Plastigage on crankshaft wiped clean of oil and tighten bearing caps to the specified torquing procedure*.
Do not turn the crankshaft.

Source of Supply for Plastigage
CARTOOL
Alfred-Brehm-Str. 5
D-8070 Ingoistadt



Remove bearing caps.
Read bearing play* by measuring the width of the flattened Plastigage with help of the supplied scale.
Correct the bearing play by installing new bearing shells, bearing shells of a different machined size or with a different color code.



Survey of Color Code Shaft Diameter
Bearing Shell Thickness*

Triple Classification Color Codes
Ge = yellow
Gn = green
Ws = white

- 1 Crankshaft diameter
- 2 Bearing play
- 3 Bearing shell thickness
- 4 Console diameter

* See Specifications

11-40/50

11 21 501 REPLACING CRANKSHAFT - Crankshaft Removed -

Note

A replacement crankshaft is supplied complete with corresponding bearing shells for main and conrod bearings.

Crankshaft Identification (Cast on Crank):

Engine	Stroke (mm)
M 40 B 16	72 (2.835")
M 40 B 18	81 (3.189")

The crankshaft is surface treated and may only be reground in the factory.

Reground crankshafts are marked with stripes of paint.

Conrod Bearing Journal (A)

1 paint stripe	Size 1 *
2 paint stripes	Size 2 *

Main Bearing Journal (B)

1 paint stripe	Size 1 *
2 paint stripes	Size 2 *

Cars with Manual Transmission:
Install pilot bearing for the transmission main shaft.

Drive in pilot bearing with Special Tools 11 2 030 and 00 5 500.

The crankshaft is marked with yellow, green or white paint depending on the main bearing journal tolerances.

The bearing shells are marked with yellow, green or white paint.

- 1 Bearing shell 1-2-3-4 (only cap)-5
- 2 Bearing shell 4 (thrust bearing, only crankcase)

Check the ground size of main bearing journals!

Installing Instructions:

Install only "yellow" bearing shells in the crankcase (regardless of the old color code mark on the crankcase). Install "yellow or green or white" bearing shells in bearing caps depending on the crankshaft bearing journal color code mark.

Install crankshaft.

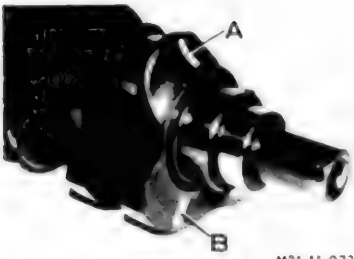
Place Type PG-1 Plastigage on the crankshaft wiped clean of oil and tighten the bearing caps with correct torque*.

Do not turn the crankshaft.

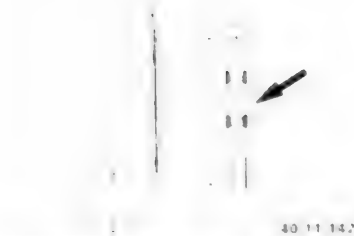
Source of Supply for Plastigage:

CARTOOL
Alfred-Brehm-Str. 5
D-8070 Ingolstadt

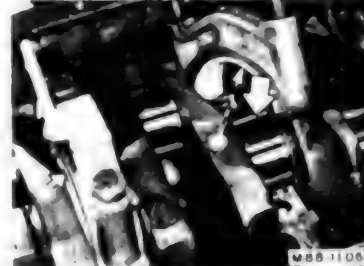
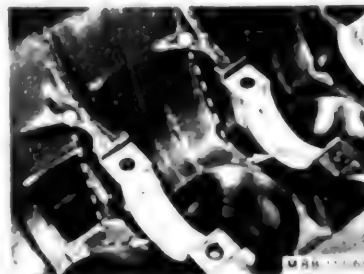
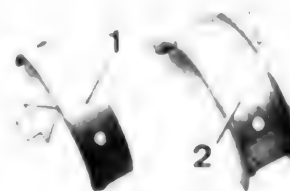
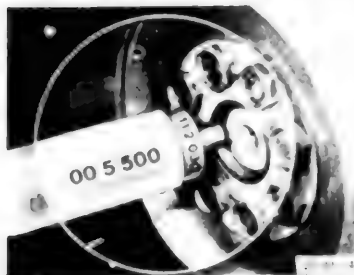
* See Specifications



M21 11 023



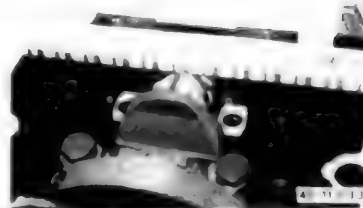
40 11 142



11-40/51



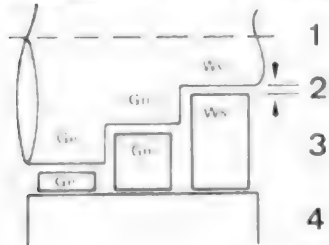
Remove bearing caps.
Read bearing play* by measuring the width of the flattened Plastigage with help of the supplied scale.
Correct the bearing play by installing new bearing shells, bearing shells of a different machined size or with a different color code.



Important!

Do not turn the connecting rods or crankshaft.

Remove bearing caps and check bearing play = 0.020 to 0.055 mm (0.0008 to 0.0022") by measuring the width of the flattened Plastigage with help of the supplied scale.
Correct the bearing play by installing new bearing shells or bearing shells with a different color code.



Survey of Color Code Shaft Diameter
Bearing Shell Thickness*

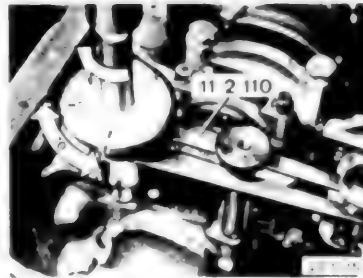
Triple Classification Color Codes:

Ge = yellow

Gn = green

Ws = white

- 1 Crankshaft diameter
- 2 Bearing play
- 3 Bearing shell thickness
- 4 Console diameter



Tightening Conrod Bolts.

Lubricate conrod bearing shells with oil.

Mount bearing caps that pair numbers are on one side.

Use new conrod bolts and tighten them in two steps.

Step 1 20 Nm (14.5 ft. lbs.)

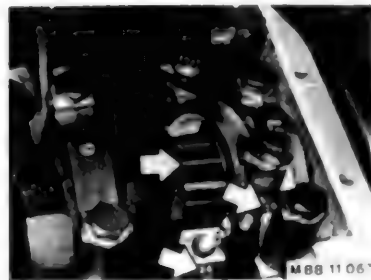
Step 2 70° torque angle



Replacing Conrod Bearing Shells:

Red or blue conrod bearing shells are installed standard according to the color code mark on the connecting rod for a pertinent ground size or crankshaft.

Install only red bearing shells of the pertinent ground size for replacement crankshafts.



Installation

Check conrod bearing play.

Place Type PG-1 Plastigage on the crankshaft wiped clean of oil in BDC position.

Mount conrod bearing caps and tighten the old conrod bolts with correct torque*.

* See Specifications

11 Engine M50

11 00 603	Engine – disassemble and assemble (engine removed)	11- 50/1
	Mounting engine on assembly stand	11- 50/1
	A. Cylinder head – remove	11- 50/2
	Intake manifold with throttle valve assembly – remove	11- 50/2
	Thermostat housing - remove	11- 50/2
	Cylinder head cover – remove	11- 50/2
	Cylinder head – remove	11- 50/3
	Camshaft adjusting procedures	11- 50/5
	Cylinder head – unscrew	11- 50/7
	B. Cylinder head – disassemble and assemble	11- 50/9
	Cylinder head – mount on assembly stand	11- 50/9
	Camshafts – remove	11- 50/10
	Valves – remove	11- 50/12
	Non-return valve – remove	11- 50/14
	Valve guide – check	11- 50/14
	Valve guide – ream	11- 50/14
	Valve seat – machine	11- 50/15
	Cylinder head mating surface – check/machine	11- 50/16
	C. Engine block / crankshaft – disassemble and assemble	11- 50/17
	Alternator – remove	11- 50/17
	Tensioning roller with console – remove	11- 50/17
	Oil filter housing – remove	11- 50/17
	Water pump – remove	11- 50/18
	Vibration damper – remove	11- 50/18
	Vibration damper hub – remove	11- 50/18
	Oil pan – remove	11- 50/19
	Lower timing case cover – remove	11- 50/19
	Timing chain and lower guides – remove	11- 50/20
	Oil pump – remove	11- 50/20
	Oil pump – disassemble	11- 50/21
	Clutch / flywheel – remove	11- 50/22
	Pilot bearing in crankshaft – replace	11- 50/22
	Rear end cover – remove	11- 50/23
	Connecting rods and pistons – remove	11- 50/23
	Connecting rods – remove/check/repair	11- 50/24
	Conrod bearing shells – replace	11- 50/25
	Pistons – replace/check	11- 50/26
	Piston rings – replace/check	11- 50/26
	Crankshaft – remove	11- 50/27
	Main bearing shells – replace	11- 50/27
	Spray nozzles in crankshaft journals – replace	11- 50/28
11 21 501	Crankshaft – replace (crankshaft removed)	11- 50/29

11-50/1

11 00 603 DISASSEMBLING AND ASSEMBLING ENGINE (Engine Removed)

General Information for Working on Valve Timing

Attention must be paid to the following if work had been carried out on the cylinder head, for which the camshaft was removed. Hydraulic valve tappets expand when without load from the camshaft and must be allowed enough time after installation to constrict again. Consequently fast assembly could cause "closed" valves to still be open and have contact with the pistons.

The following waiting times must be allowed between installation of the camshaft and mounting of the cylinder head

Ambient Temperature:	Time:
20° C	4 minutes
10 to 20° C	11 minutes
0 to 10° C	30 minutes

After installation of the camshaft and timing chain the engine may first be cranked after the following waiting times

Ambient Temperature:	Time:
20° C	10 minutes
10 to 20° C	30 minutes
0 to 10° C	75 minutes

Working on Valve Train with Mounted Cylinder Head

Turn crankshaft in engine's direction of rotation to approx. 30° from the TDC mark, so that in this manner no pistons are in TDC.

Install camshaft so that the cam peaks of cylinder no. 1 overlap.

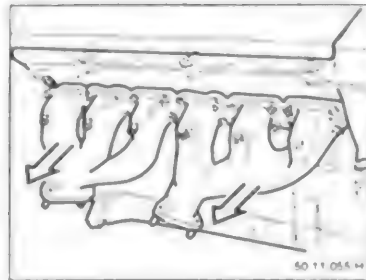
Conform with the above mentioned waiting times.

Turn crankshaft back to TDC position and mount timing chain.

Crank engine not earlier than 10 minutes after installation of the camshaft.

Disassembling and repairing the engine are described in chronological sequence on the following pages. The positions shown in the list of contents will help in taking up work again after an interruption or finding different points more easily. They only describe the direct removal or installation, but not the complete scope of work.

If necessary, drain engine oil and fill engine with new engine oil after completion of engine assembly. Check oil level after installation and road test.



Mounting Engine on Assembly Stand

Removing Exhaust Manifold.

Unscrew nuts.
Lift exhaust manifold off.

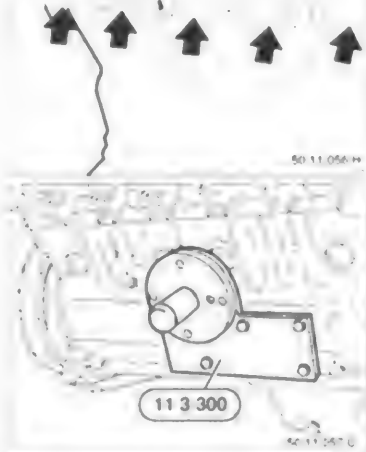
Installation

Replace nuts.
Coat threads with copper paste**
Tightening torque*

Shorter manifold is at rear

Installation

Graphite surfaces of gaskets face the cylinder head



Mount engine on Special Tool 00 1 490
using Special Tool 11 3 300.

* Refer to Specifications
** Source of Supply: HWB

11-50/2

A Removing Cylinder Head

o Removing Intake Manifold with Throttle Valve Assembly

This operation will already have been carried out on an engine which was removed from the car.

Refer to Group 11 in the Model Repair Manual

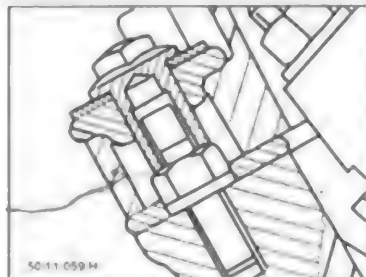
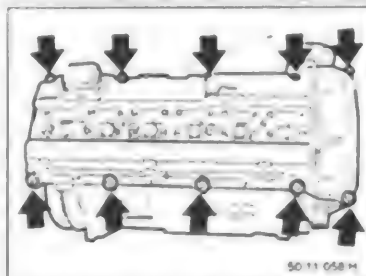
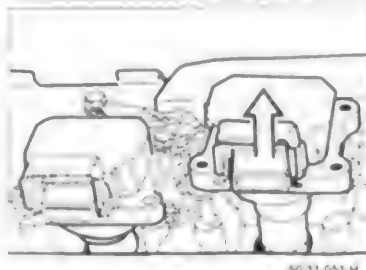
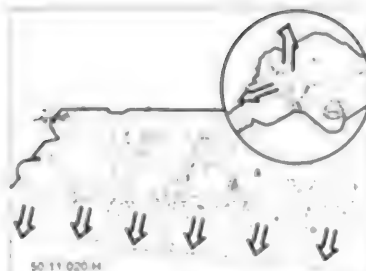
o Removing Thermostat Housing

Note:
This operation is necessary to be able to mount the cylinder head on Special Tool 11 1 065.

Unscrew suspension eye.
Unscrew thermostat housing

Installation:
Replace gasket.

Installation:
Check direction of installation.
Vent hole or arrow faces up.
Replace O-ring.



o Removing Cylinder Head Cover

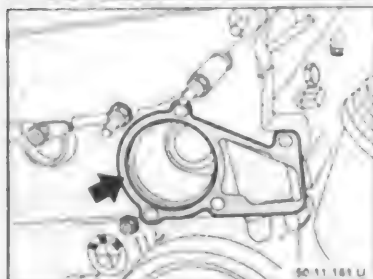
If applicable, disconnect plugs on ignition coils

Remove ignition coils

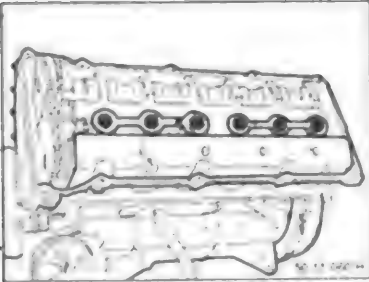
Installation:
Place paper gasket between valve cover and ignition coil (galvanic decoupling).

Unscrew cylinder head cover

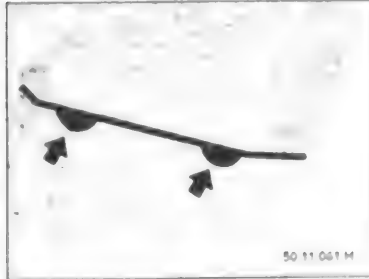
Note:
The cylinder head cover uses rubber mounts and gaskets for vibrational separation from the cylinder head. Check arrangement of rubber liners.



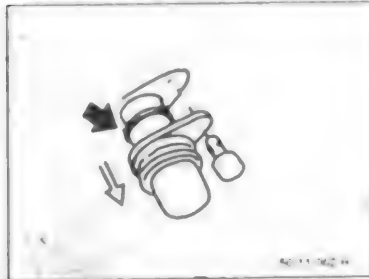
11-50/3



Installation
Check gaskets, replacing them if necessary.
Place gaskets on cylinder head



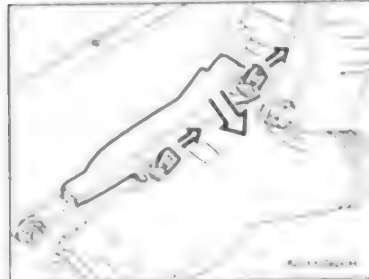
Installation:
When mounting the cylinder head cover, check for correct seating of gasket on back of the cylinder head



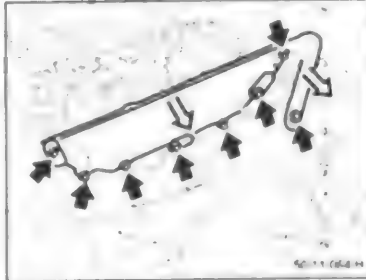
o Removing Cylinder Head

Remove sender.

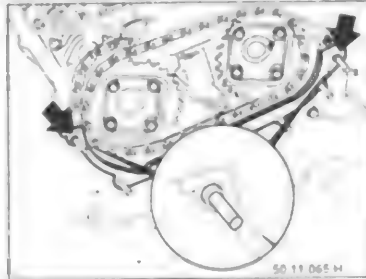
Installation
Check seal, replacing if necessary



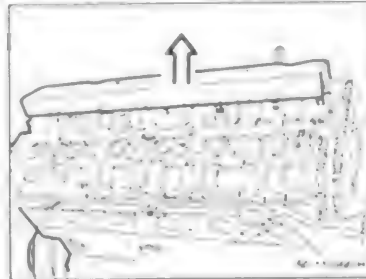
Take off electric wiring channel



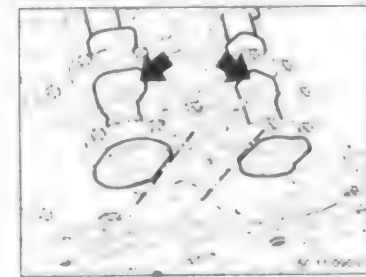
Unscrew suspension eye and upper timing case cover.



Installation
Replace gasket
Check dowel sleeves

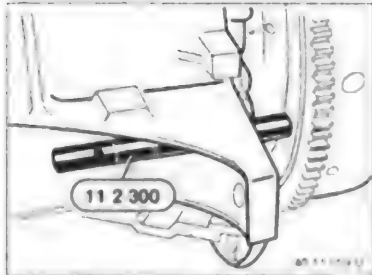


Pull cover off



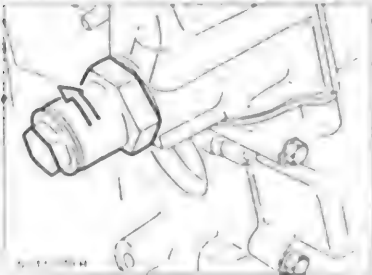
Crank engine in direction of rotation until cam peaks of intake and exhaust cams in cylinder no. 1 face each other.
Arrows on sprockets face up.

11-50/4



Hold crankshaft in TDC position with Special Tool 11 2 300.

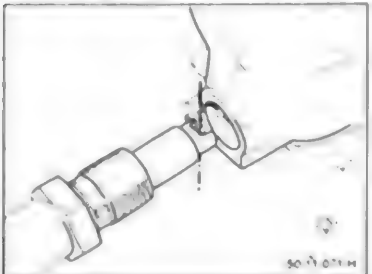
Important!
Remove special tool before operating the engine.



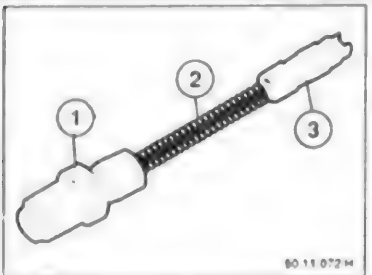
Unscrew chain tensioner

Caution!
Spring pressure.

Installation
Replace gasket.
Tightening torque*.



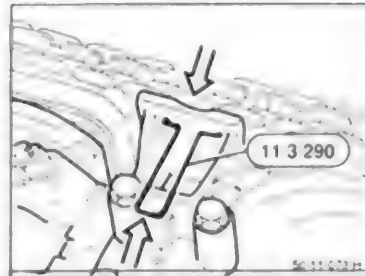
Installation
Align groove in piston perpendicular to the tensioning rail.



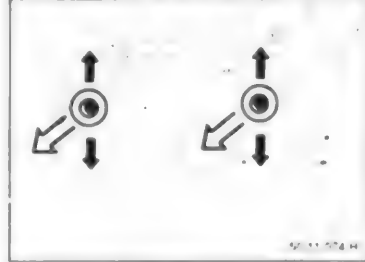
Arrangement of Parts:

- 1 - Sleeve
- 2 - Spring
- 3 - Piston

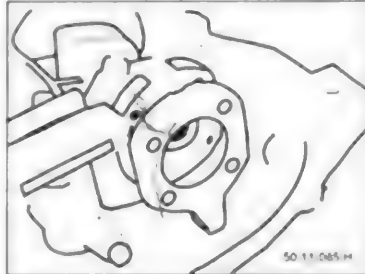
* Refer to Specifications



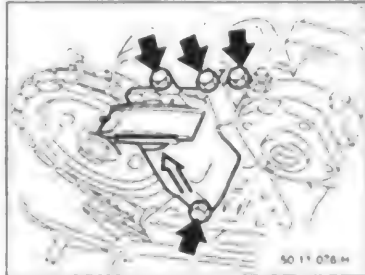
Press upper chain tensioner down and arrest by inserting Special Tool 11 3 290



Unscrew sprockets.
Lift both sprockets off complete with chain



Installation
Lift pulse sender off of the intake camshaft



Unscrew console for upper chain tensioner.

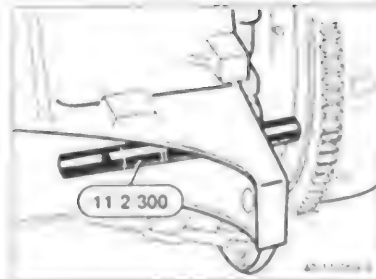
* Refer to Specifications

11-50/5

Unscrew chain guide

Lift sprocket off together with chain

Important!
Prevent chain from slipping down with a piece of wire.



o Camshaft Adjusting Procedures

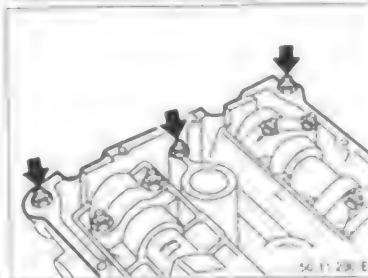
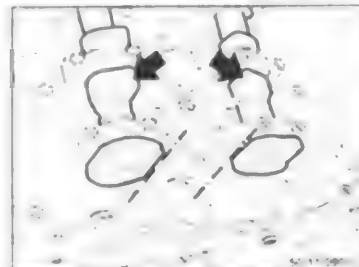
Hold crankshaft in TDC position with Special Tool 11 2 300.

Important!
Remove special tool before operating the engine.

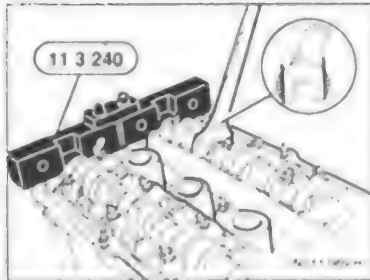
Important!
If it is necessary to correct the camshaft adjustment to such an extent that there is valve movement in cylinders 1 and 6, first turn the crankshaft about 30° away from TDC position in the engine's direction of rotation and return to TDC only after turning the camshaft.
This prevents contact between the valves and pistons.

Turn camshaft until the cam peaks of intake and exhaust cams for cylinder no. 1 face each other.

Unscrew the three rear studs for the valve cover

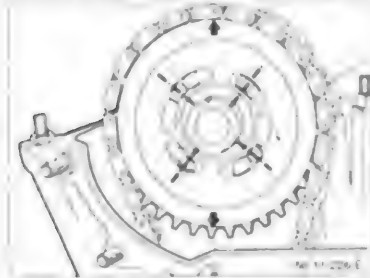


11-50/6

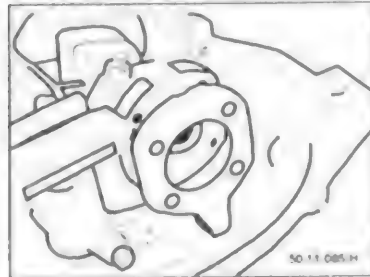


Hold camshaft with Special Tool 11 3 240
Camshafts may be turned on the hexagon
with a 24 mm wrench

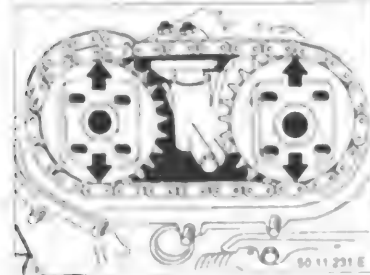
Important!
Be careful that the bearing plate is not
damaged.
Machine the fork wrench to size according-
ly if necessary



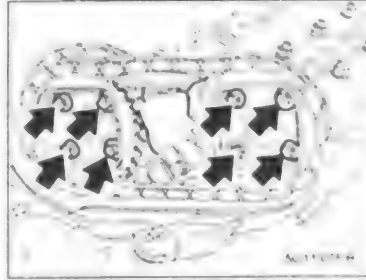
Install primary timing chain on the spro-
cket and center with the exhaust camshaft.
Arrow on sprocket faces up.
Mount sprocket that the tapped bores are
to the left of the slots as the sprocket will
be moved to the left when installing the
chain tensioner



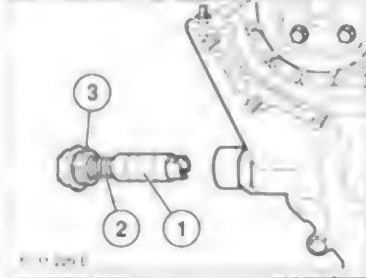
Install pulse sender on the intake camshaft



Mount both sprockets complete with chain
Arrows on sprockets face up.

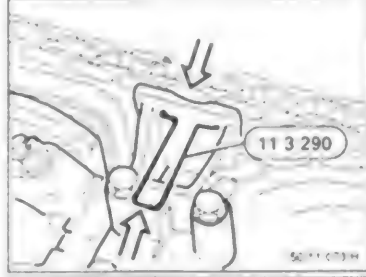


Install bolts to be turnable without play,
but do not tighten at this stage

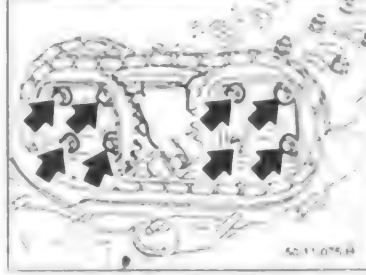


Screw in and tighten chain tensioner
sleeve
Insert chain tensioner piston (1) that the
guides engage in the tensioning rail
Install spring (2) and bolt (3).

Installation
Replace seal
Tightening torque*.



Unlock chain tensioner arrest
Remove Special Tool 11 3 290

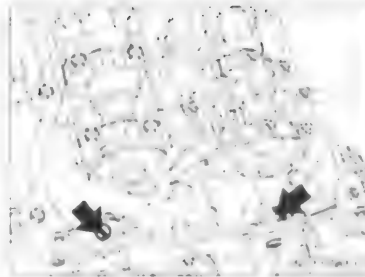


Tighten both sprockets, beginning at the
intake side, with an initial torque of ap-
prox. 5 Nm and afterwards in a second
step to the specified final torque of 22 Nm

* Refer to Specifications

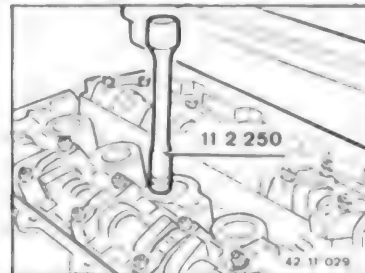
11-50/7

Remove Special Tools 11 2 300 and
11 3 240.
Crank engine at least twice in direction of
rotation.
Check camshaft adjustment.

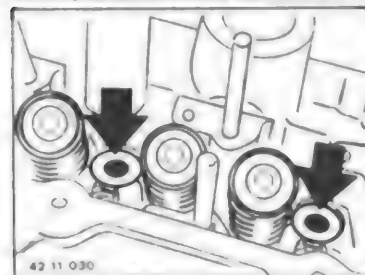


o Unscrewing Cylinder Head

Unscrew timing case cover from cylinder
head



Unscrew cylinder head bolts in several
steps from outside to inside using Special
Tool 11 2 250.
Lift cylinder head off.

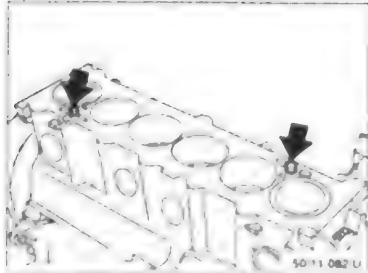


Note
Some of the washers are locked in the
standard cylinder heads to prevent them
from being lost.
When installing a new cylinder head, install
new washers *without* locking them.
Make sure that no washers are missing.



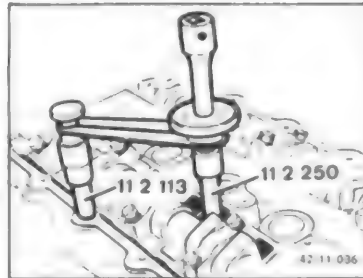
Installation:
When installing the cylinder head, conform
with the waiting time for hydraulic valve
tappets.
Refer to "General Information".

11-50/8

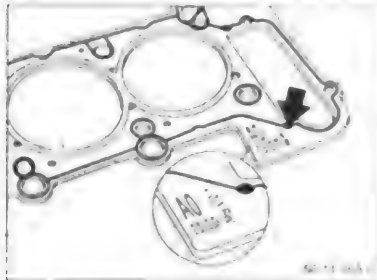


Installation:

Cleaning mating surfaces on cylinder head and crankcase, if necessary removing remainders of gaskets with gasket remover** and a hard wood scraper. Make sure that remainders of gaskets do not fall into oil and coolant bores.
Install new cylinder head gasket.
Check dowel sleeves (1) for damage and correct installed position.



Note
Use torque angle tester together with Special Tools 11 2 250 and 11 2 113

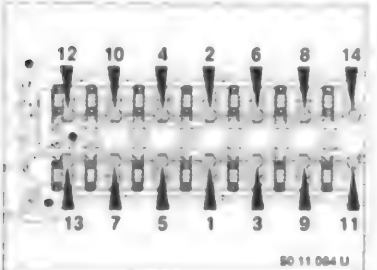


Installation:

Gaskets which are 0.3 mm thicker are available for machined (ground) cylinder heads (refer to "Checking Machining Cylinder Head Mating Surface").

Identification:

2.0 for 2.0 liter
2.5 for 2.5 liter
+ 0.3 for 0.3 mm thicker gasket for repair-machined cylinder head



Installation:

Mount cylinder head and tighten new bolts (lightly oiled) in sequence of 1 ... 14 in three steps.

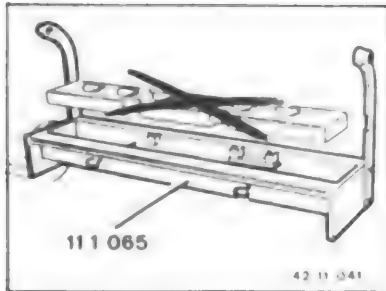
Step 1: Tightening torque	30 ± 2 Nm
Step 2: Torque angle	90 ± 3°
Step 3: Torque angle	90 ± 3°

Important!

Cylinder head bolts may only be used once. Keep oil out of tapped bores in the engine block (danger of cracking the block, wrong tightening torque values).

** Source of Supply: BMW Parts

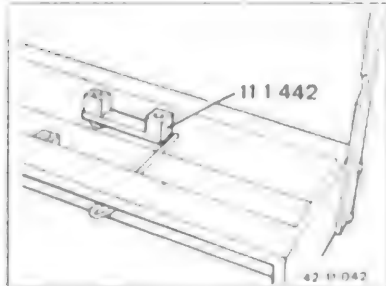
11-50/9



8. Disassembling and Assembling Cylinder Head

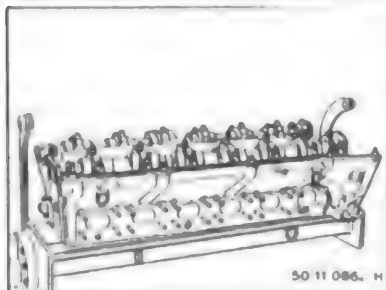
o Mounting Cylinder Head on Assembly Stand

Mount Special Tool 11 1 065 on Special
Tool 00 1 493.
Do not insert Special Tool 11 0 180 (tray).



Note

Bolt Special Tool 11 1 442 on already sup-
plied assembly fixtures (11 1 065).



Mount cylinder head on assembly fixture
with two cylinder head bolts.

11-50/10

• Removing Camshafts

Important!

Camshafts could be damaged or broken in case of improper removal/installation without the fixture. In addition, valve could be bent through contact with the piston crowns when mounting the cylinder head on the crank.

=====

Always conform with instructions and sequence

Prepare Special Tool 11 3 260 for a six cylinder engine

Unscrew spark plugs
Mount fixture and bolt in the tapped bores for spark plugs.
Tightening torque = 23 Nm (17 ft. lbs.)

Apply load on bearing caps by turning the eccentric shaft.
Unscrew all bolts for bearing caps.

Installation
Tightening torque*

• See Specifications

Release and remove fixture
Lift out bearing caps and camshaft

Installation
Install camshafts that the cam peaks for intake and exhaust valves in cylinder number 1 face each other

Installation
Identification of Camshafts on Flange for Sprockets

E = Intake camshaft
A = Exhaust camshaft

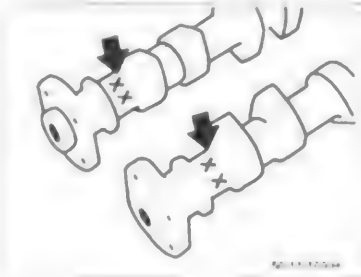
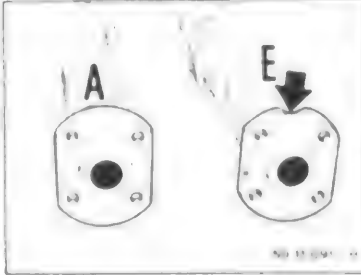
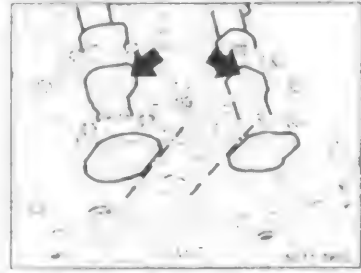
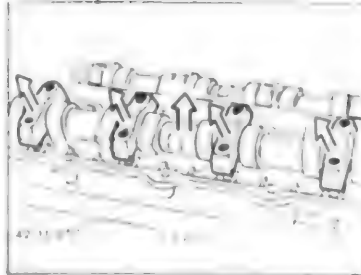
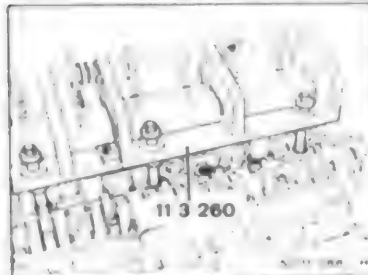
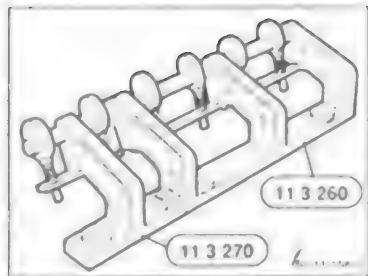
Identification on Front of Camshafts:

X X

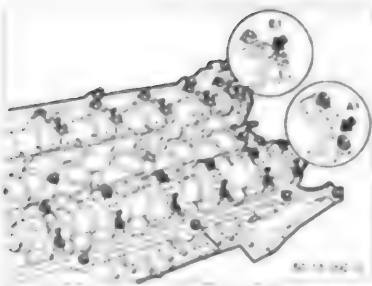
A = 2.5 liters
B = 2.0 liters

E = Intake
A = Exhaust

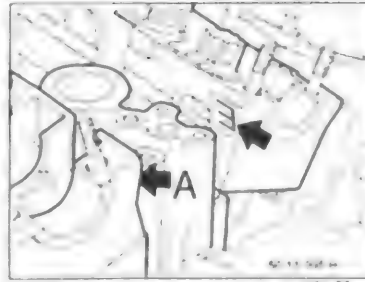
Example: EB = Intake 2.0 liters



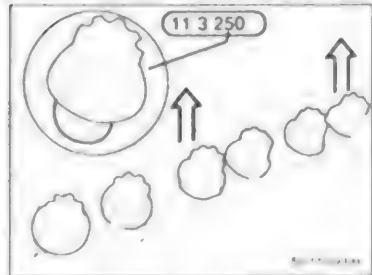
11-50/11



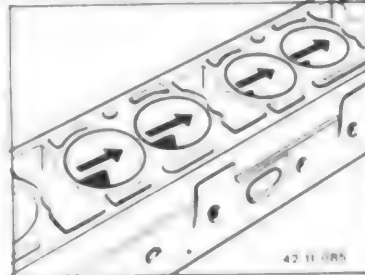
Installation
Bearing caps are marked with
A 1 ... A 7 for the exhaust side and
E 1 ... E 7 for the intake side.
and this identification can be read from the
exhaust side



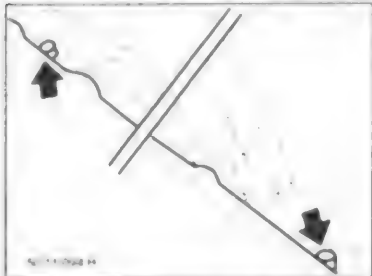
Installation
Bearing plates are marked with
"A" for exhaust side and
"E" for intake side



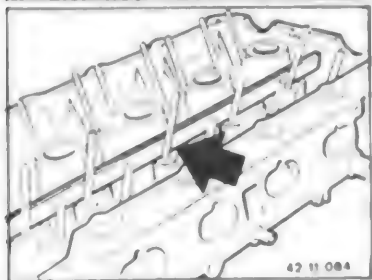
Hold valve clearance compensators tight
with Special Tools 11 3 250 (suction cups)
Lift bearing plate out complete with valve
tappets



Installation
Check bearing surfaces of valve clearance
compensators for wear (scoring)



Installation
Note centering sleeves on mounting bolts
for bearing caps 2 and 7.



Note
If the cylinder head is replaced because of
mechanical defects (cracks, distortion), the
bearing surfaces of the bearing plates
must be checked on the old cylinder head
for distortion with a steel ruler
Max. gap: 0.05 mm.
Also replace the bearing plates if this gap
is exceeded

11-50/12

Installation

Hydraulic valve tappets expand when without load from the camshaft and must be allowed enough time after installation to constrict again. Consequently fast assembly could cause "closed" valves to still be open and have contact with the pistons.

The following waiting times must be allowed between installation of the camshaft and mounting of the cylinder head.

Ambient Temperature:	Time
20° C	4 minutes
10 to 20° C	11 minutes
0 to 10° C	30 minutes

After installation of the camshaft and timing chain the engine may first be cranked after the following waiting times:

Ambient Temperature:	Time
20° C	10 minutes
10 to 20° C	30 minutes
0 to 10° C	75 minutes

If necessary, proceed as described below.

Working on Valve Train with Mounted Cylinder Head:

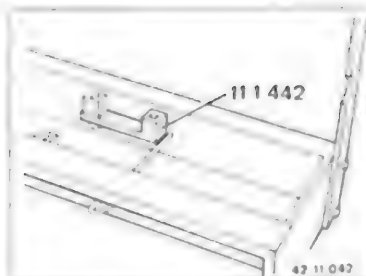
Turn crankshaft in engine's direction of rotation to approx. 30° from the TDC mark, so that in this manner no pistons are in TDC.

Install camshaft so that the cam peaks of cylinder no. 1 overlap.

Conform with the above mentioned waiting times.

Turn crankshaft back to TDC position and mount timing chain.

Crank engine not earlier than 10 minutes after installation of the camshaft.

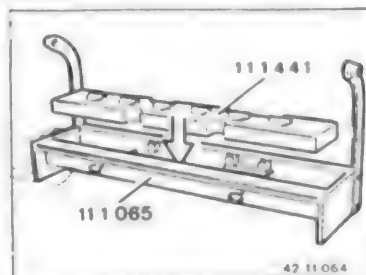


6 Removing Valves

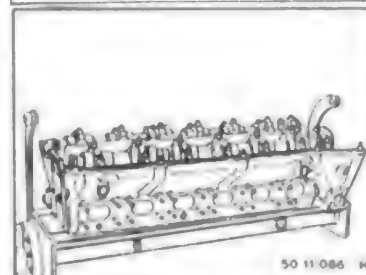
Mount Special Tool 11 1 065 on Special Tool 00 1 490.

Note

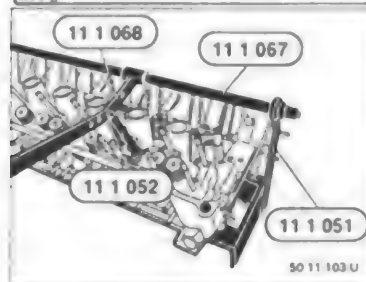
Bolt Special Tool 11 1 441 on already supplied assembly fixtures (11 1 065).



Insert Special Tool 11 1 441 (tray) into assembly fixture.

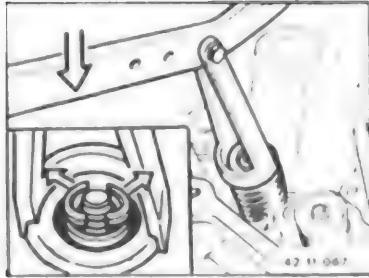


Mount cylinder head on assembly fixture with two cylinder head bolts.

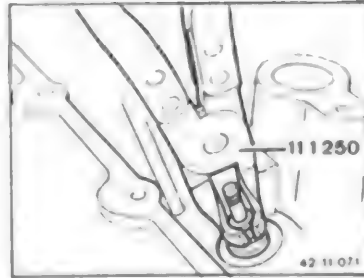


Screw on Special Tool 11 1 051. Mount Special Tool 11 1 068 together with Special Tools 11 1 052 and 11 1 067.

11-50/13



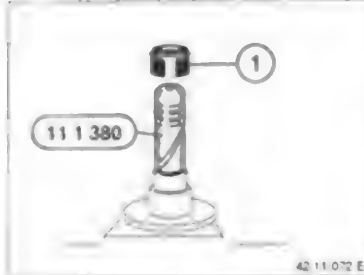
Compress valve springs and take out valve collets.
Remove valve springs and spring retainers.
Take tray out of the assembly fixture from below and pull out valve.



Pull off valve stem seal with Special Tool 11 1 250.

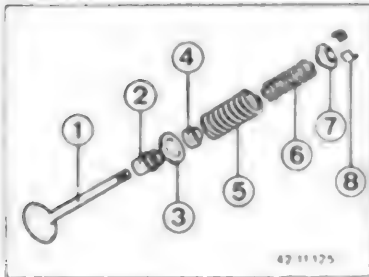
Installation

If one spring of the spring set (inner or outer spring) is damaged or broken, both springs must be replaced.
Only use inner and outer springs of the same make and with the same color code.



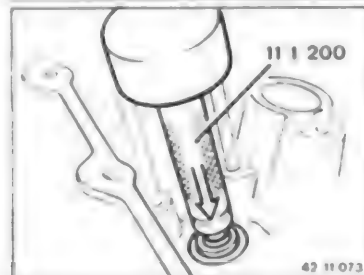
Installation

Lubricate valve stem with oil and insert valve.
Apply Special Tool 11 1 380.
Lubricate new valve stem seal with oil and install.



Installed Order:

- 1 Valve
- 2 Inner spring retainer
- 3 Valve stem seal
- 4 Outer spring retainer
- 5 Inner spring
- 6 Outer spring
- 7 Upper spring retainer
- 8 Valve collets



Installation

Press on valve stem seal against the stop by hand with Special Tool 11 1 200.

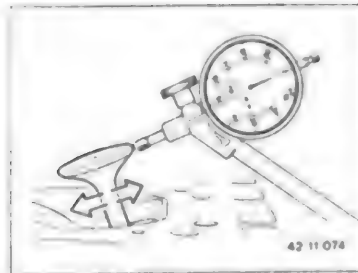
11-50/14



- Remove Check Valve
Unscrew valve.



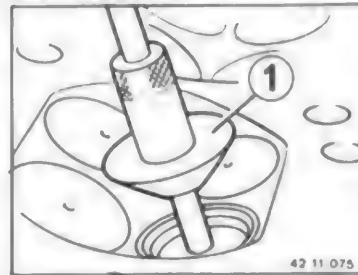
- Installation
Replace O-ring.
Tightening torque:



- Checking Valve Guide

To check, insert a new valve in such a manner that the valve stem end is flush with the valve guide.
Apply dial gage and measure the tilt clearance.

Max. permissible tilt clearance = 0.5 mm (0.020").



- Reaming Valve Guide

Valve guide must be reamed and a repair valve with oversize stem diameter (+ 0.1 or 0.2 mm / 0.004 or 0.008") installed when there is excessive play between the valve stem and valve guide.
Press guide (1) on valve seat and ream valve guide from the combustion chamber side.
Turn down the reamer once.

Note
The valve seat must be machined after reaming.

- See Specifications

11-50/15

o Machining Valve Seat

Important!

If more than 0.2 mm has to be machined off the valve seat, a valve with a thicker valve head must be installed (change in compression).

The following valve versions are available in addition to the standard valves:

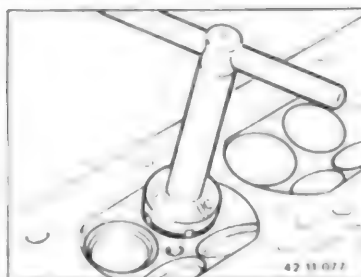
Stem Oversize	0 mm	0.1 mm	0.2 mm
Valve Head Thickness Oversize	0.2 mm	0.2 mm	0.4 mm
For Machining on Seat Insert Ring More Than mm	0.2 mm	0.2 mm	0.4 mm
Identification on Stem (see picture)	0.0	0.1	0.2

Note for Second Machining

If size "0.0" is already installed and valve seat machining exceeds 0.2 mm, install size "0.2".

Caution!

Valves with excessively thick valve heads cause engine damage (knock limit is exceeded).



Machining Valve Seat

Machine valve seat to the instructions of the tool supplier using Special Tool 00 3 520 or 00 3 580 (dimensions and angles are given below).

Correction Cutters from "Neway"

45° = No. 609

60° = No. 694

0° = No. 701

After machining the valve seat angle, produce valve seat diameter "M" and valve seat width "B" by machining correction angle "Y" and correction depth "KT" perpendicularly.

Grind in valve with grinding paste and check for leaks.

Important!

Keep grinding paste out of the valve guide.

Valve Seat Dimensions*

M = Valve seat diameter

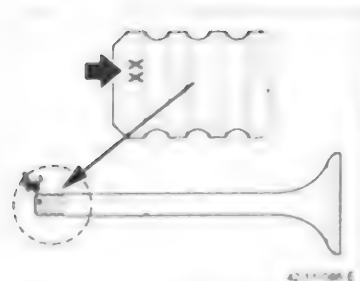
B = Valve seat width

Y = Correction angle

F = Correction diameter

KT = Correction depth

Location of Valve Identification

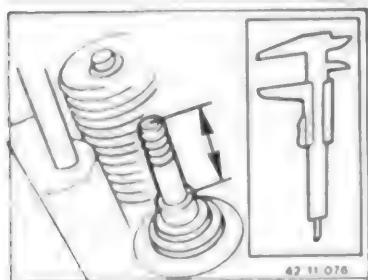
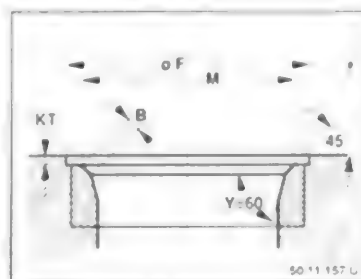


The amount of valve seat machining can be determined as follows:

Insert valve, measure protrusion from valve stem to valve guide and note value. Machine valve seat.

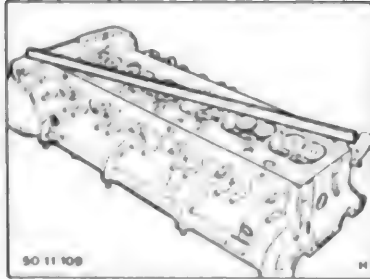
Reinstall the same valve, measure protrusion from valve stem to valve guide and note value.

The difference between both measurements is equal to the amount of machining.



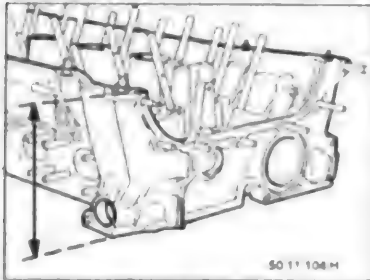
* See Specifications

11-50/16



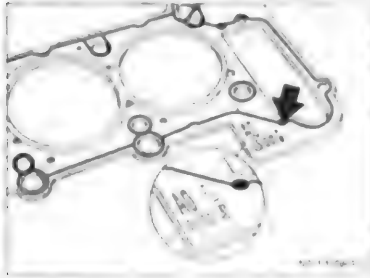
• Checking / Machining Cylinder Head Sealing Surface:

Check levelness of the cylinder head sealing surface with a standard steel ruler
 Max. deviation = 0.03 mm (0.0012")



Remove all attachments on the cylinder head to grind the sealing surface.

Max. grinding: 0.3 - 0.05 mm
 (0.012 - 0.002")
 New cyl. head height: 140 - 0.1 mm
 (5.512 - 0.004")
 Machining limit: 139.55 mm
 (5.494")

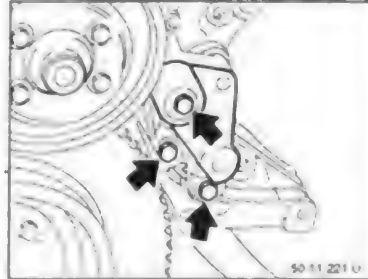


0.3 mm (0.012") thicker cylinder head gaskets are available for 0.3 mm (0.012") grinding

11-50/17

C. Disassembling and Assembling Engine Block / Crankshaft Drive

o Removing Alternator



Unscrew console.

Unscrew bolts and remove alternator.

Installation:
Tightening torque*.



Note:
The hydraulic belt tensioner is filled with oil, a removed unit must only be stored standing upright. Incorrectly stored units can normally be bled by compressing them several times.

Installation:
Note direction of installation.

Installation:
Note retainer on bearing of reversing roller.

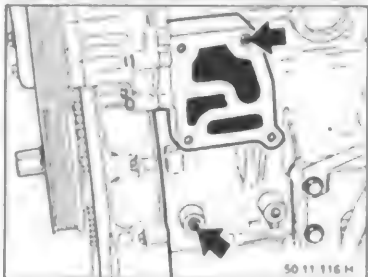


o Removing Oil Filter Housing

Unscrew bolts and remove oil filter housing.

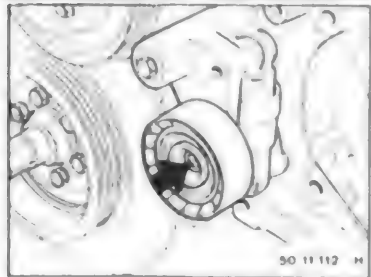
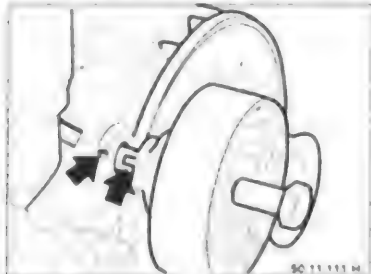
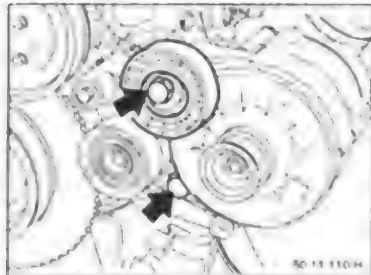
o Removing Tensioning Roller with Console

Unscrew tensioning roller.

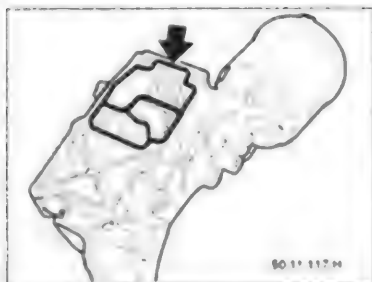


Installation:
Check dowel sleeves.

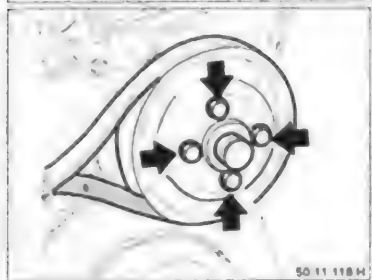
* Refer to Specifications



11-50/18



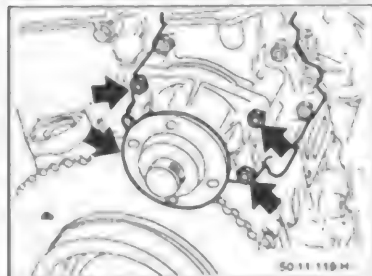
Installation:
Replace gasket.



• Removing Water Pump

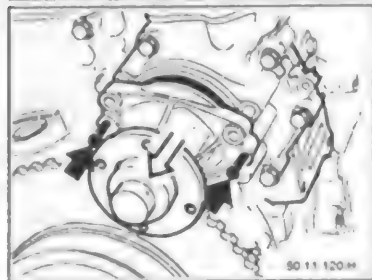
Hold pulley tight on drive belt and unscrew bolts.

Installation:
Tightening torque*.



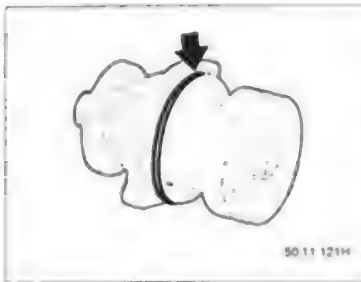
Unscrew bolts.

Installation:
Tightening torque*.

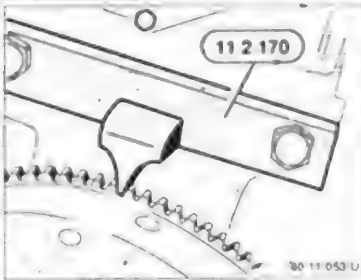


Screw two M 6 screws into tapped bores (1) and press water pump out of end cover uniformly.

• Refer to Specifications



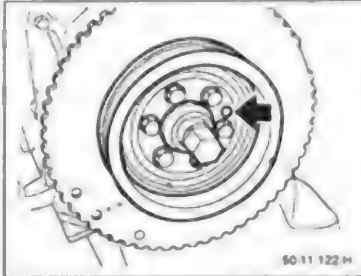
Installation:
Replace O-ring and coat with lubricant**
Tightening torque*



• Removing Vibration Damper

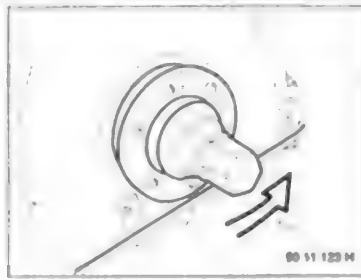
Hold engine with Special Tool 11 2 170

Important!
Do not use a mandrel to hold the engine



Unscrew bolts on vibration damper and remove vibration damper

Installation:
Align dowel pin bore in vibration damper with the dowel pin
Tightening torque*.

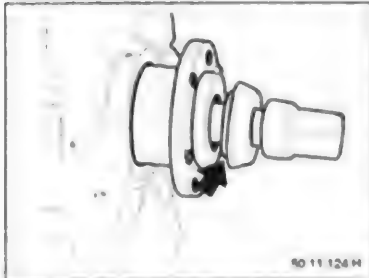


• Removing Vibration Damper Hub

Hold flywheel with Special Tool 11 2 170.
Unscrew central bolt.
Remove washer and hub.

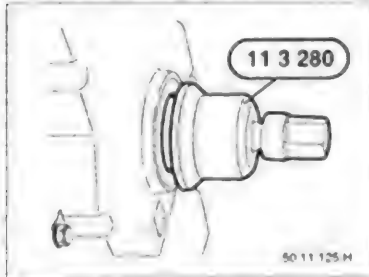
• Refer to Specifications
** Source of Supply: BMW Parts

11-50/19



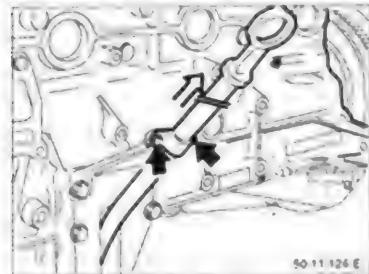
SO 11 124 H

Installation
Align groove of hub with woodruff key
Collar of washer faces hub
Tightening torque for central bolt = 410 Nm
(296 ft. lbs.)



SO 11 125 H

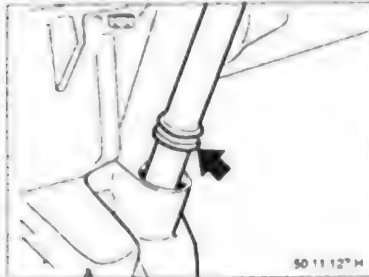
Installation
Press in new radial oil seal flush with
Special Tool 11 3 280 in conjunction with
the central bolt and mounted timing case cover



SO 11 126 E

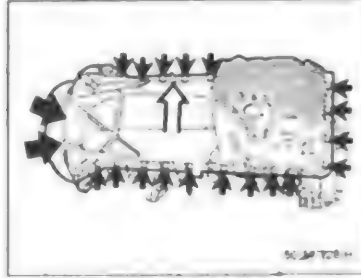
• Removing Oil Pan

Unscrew and pull out guide pipe for the oil dipstick



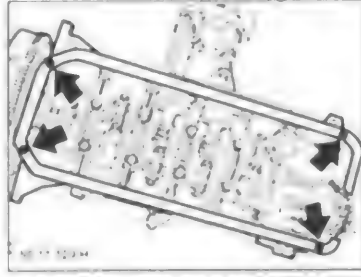
SO 11 127 H

Installation
Replace seal.



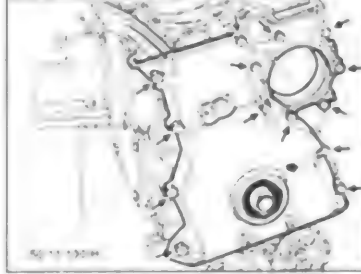
SO 11 128 H

Unscrew all bolts and take off oil pan



SO 11 129 H

Installation
Replace gasket
Fill in joints to the front timing case and
rear end cover with permanently elastic
black sealing compound 3 Bond 1207 B**

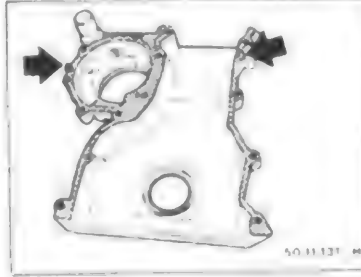


SO 11 130 H

• Removing Lower Timing Case Cover

Unscrew bolts
Lift off timing case cover

Note
The timing case cover can also be removed without removal of the water pump

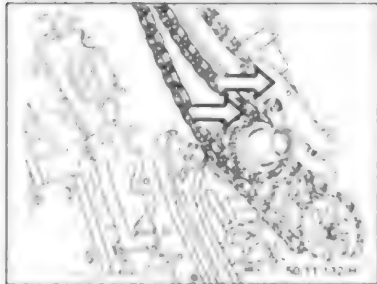


SO 11 131 H

Installation
Replace gaskets.
Check dowel pins.

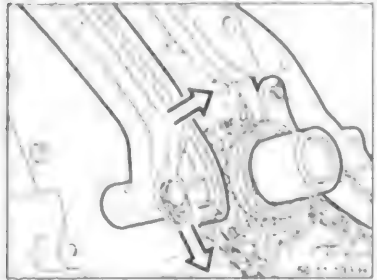
** Source of Supply: HWB

11-50/20

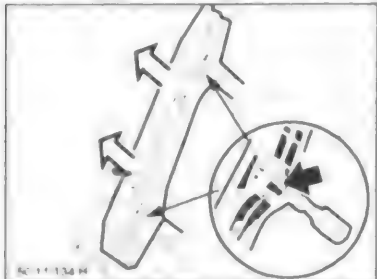


o Removing Lower Timing Chain and Guides

Fold tensioning rail down.
Lift timing chain out.



Remove tensioning rail.



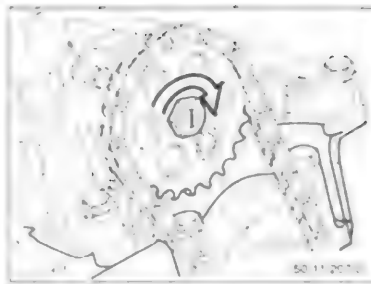
Removing Chain Guide:

Lift upper and lower retainers.
Pull chain guide off.



Remove chain tensioner for oil pump.

Note:
The chain tensioner is no longer installed.
The chain tensioner may also be omitted in repair work.



o Removing Oil Pump

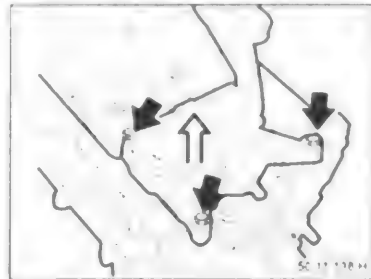
Unscrew sprocket nut.

Important!
Left-hand threads.

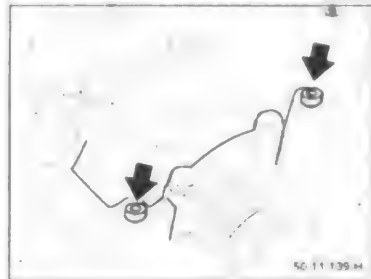


Lift sprocket off together with chain.

Installation
Check for tooth engagement

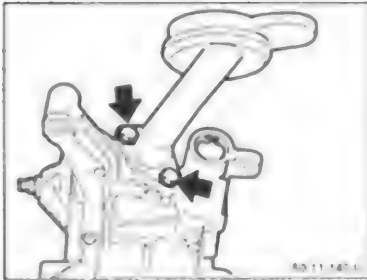


Unscrew oil pump.

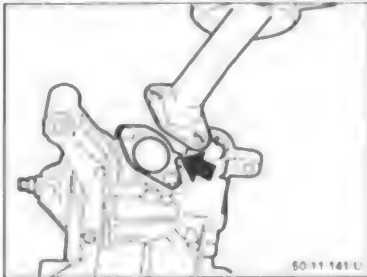


Installation
Check dowel sleeves.

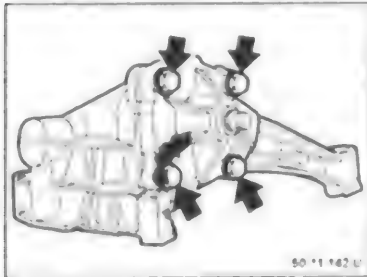
11-50/21



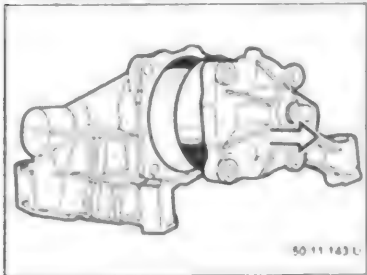
- **Disassembling Oil Pump**
Unscrew intake pipe



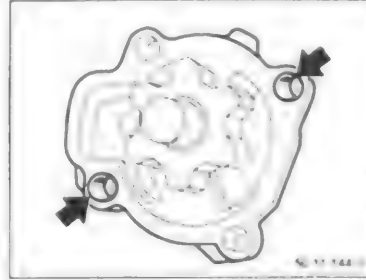
- Installation*
Tab on gasket faces the suction basket.



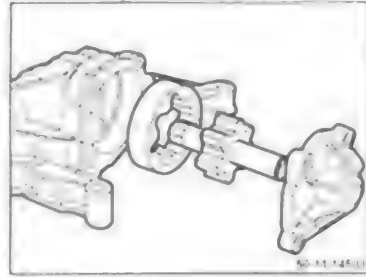
- Screw on pump body.



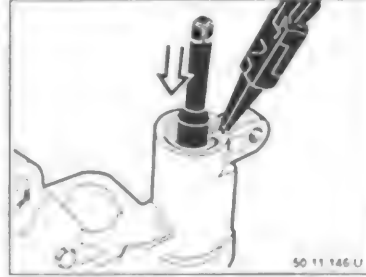
- Remove front pump section with shaft and rotor.



- Installation*
Check dowel sleeves.

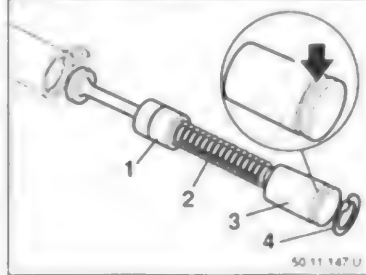


- Installation*
Check all parts for wear
Scoring in body
Wear on rotors
Wear and scoring on bearing surfaces



- Removing Safety Valve.**
Press down sleeve slightly with a suitable mandrel.
Lift out circlip and remove valve.

- Caution!*
Spring force.

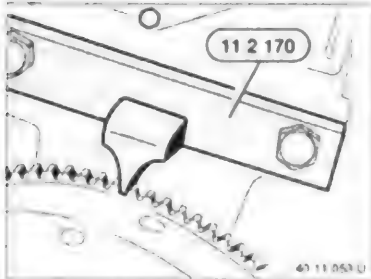


- Installation*
1 Plunger
2 Spring
3 Sleeve with O-ring
4 Circlip

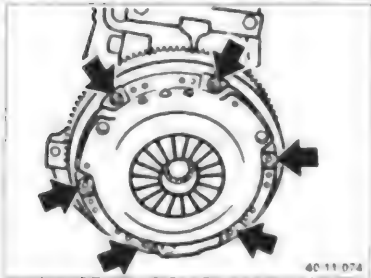
- Measure length of unloaded spring (2).
Specification: 84.1 mm (3.311").

- Important!*
Replace O-ring.
Don't damage the sleeve during installation.

11-50/22

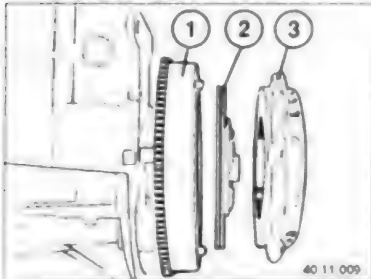


- o Removing Clutch / Flywheel
- Hold flywheel with Special Tool 11 2 170



- o Unscrew bolts uniformly.
- o Remove pressure plate and drive plate

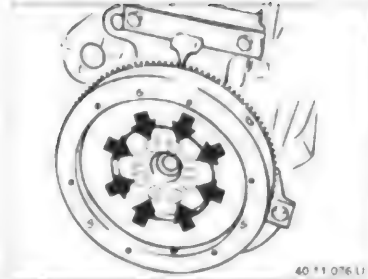
Installation
Check dowel pins.



- Installation.*
1 = Flywheel
2 = Drive plate
3 = Pressure plate

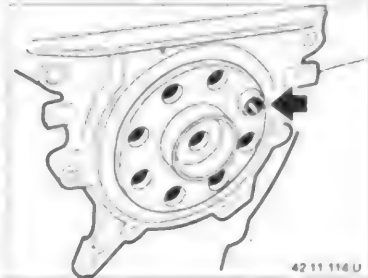
Flatter surface of drive plate (2) points to flywheel (1).

Center the drive plate using Special Tool 21 2 100 and tighten bolts in several steps
Tightening torque: 23 Nm.

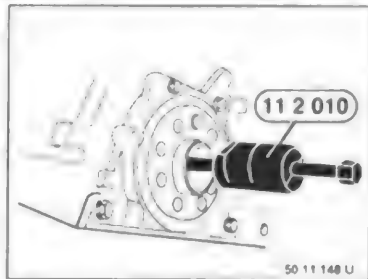


- o Unscrew bolts and remove flywheel

Installation
Clean threads of tapped bores and install new bolts coated with micro-encapsulated cement
Tightening torque: 121 Nm

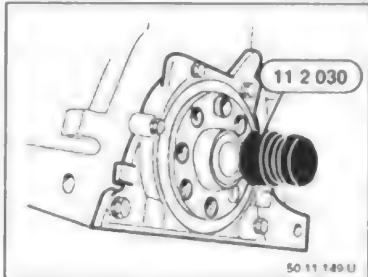


- Installation*
Check dowel sleeve



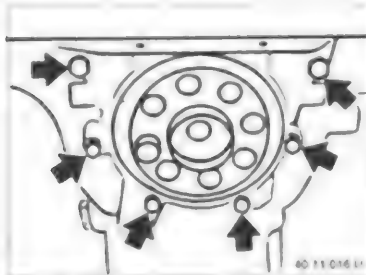
- o Replacing Pilot Bearing in Crankshaft

Remove pilot bearing with Special Tool 11 2 010 or 11 2 340.

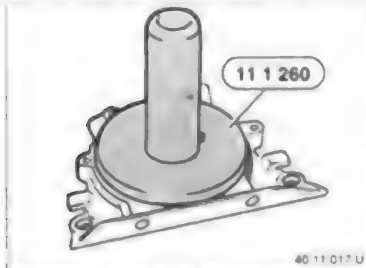


Installation:
Insert pilot bearing and drive it in as far as stop with Special Tool 11 2 030.

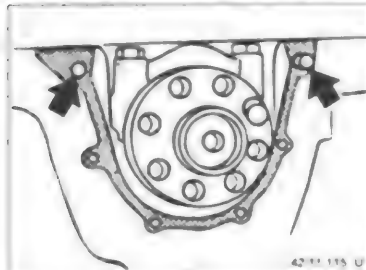
11-50/23



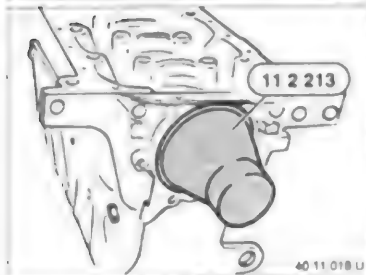
- **Removing Rear End Cover**
Unscrew bolts and take off cover.



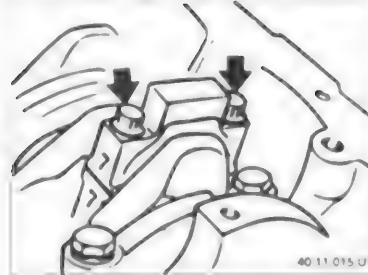
- Installation**
Lift out radial oil seal and drive in new seal with Special Tool 11 1 260.



- Installation**
Replace gasket.
Check dowel sleeves.

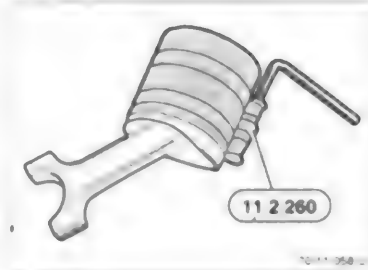


- Installation**
Apply Special Tool 11 2 213 on crankshaft.
Lubricate sealing lip of radial oil seal with oil.
Slide on and tighten cover.



- **Removing Connecting Rod and Piston**
Unscrew conrod bearing cap.
Lift out connecting rod and piston from the cylinder head end.

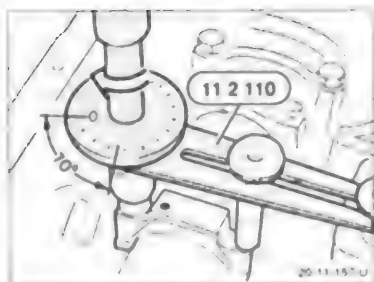
Important!
Insert piston, connecting rod and bearing shells in the same installed position.
Connecting rods and bearing caps are marked with the same pairing number — don't mix them up.



- Installation**
Lubricate piston and piston rings lightly with oil.
Align gaps of piston rings (offset approx. 120°, but do not position over piston pin bore).
Compress piston rings with Special Tool 11 2 260.

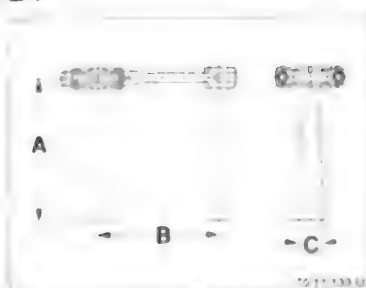
- Installation**
Insert piston with arrow facing the camshaft drive.
Compressor must bear firmly on the crankcase all around.
Press in piston with light knocks (e.g. with handle of a hammer).
Guide crankshaft journal and connecting rod together at the same time.

11-50/24



Installation
Conrod Bolt Tightening Procedures:
 Lubricate conrod bearing shells with oil.
 Mount bearing caps that pairing numbers are matched.
 Install new conrod bolts.
 Tighten conrod bolts in two steps.

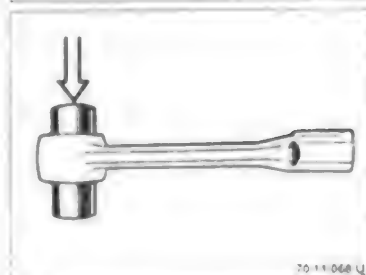
Step 1 = 23 Nm (17 ft. lbs.) torque
 Step 2 = 70° torque angle



Checking Connecting Rod:

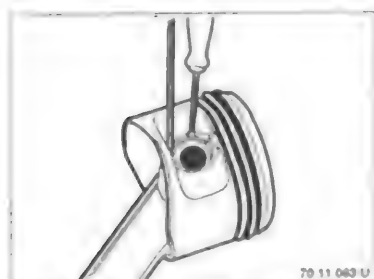
Check connecting rod for deviation from parallel and displacement.

A = Test distance = 150 mm (5.906")
 B = Permissible deviation in parallel at distance A = max. 0.04 mm (0.0016")
 C = Permissible displacement to either side = max. 0° 30'



Checking Piston Pin Bush:

It should be possible to have the piston pin slide through the bush by hand with slight force and no noticeable play.

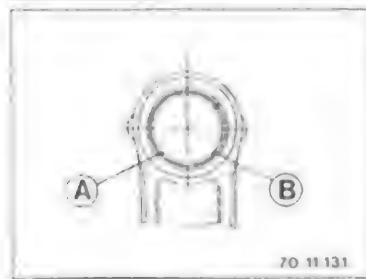


Removing / Checking / Repairing Connecting Rods

Lift out circlip and press out piston pin.

Important!
 Pistons and piston pins are matched and must not be mixed up.

Installation
 Insert circlip that its opening is opposite the hole.

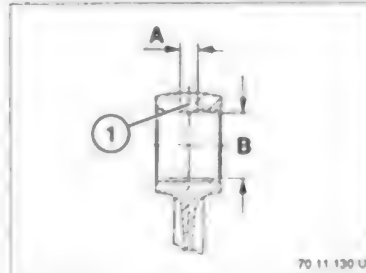


Replacing Piston Pin Bush:

Press out old bush with a suitable mandrel (23.5 mm / 0.925" dia.).
 Press in new bush; location of bush gap optionally at point A or B.

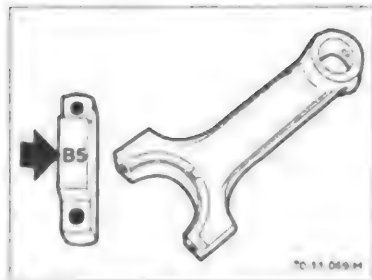


Installation
 Install connecting rod on piston in such a manner that with the pairing number seen the arrow on the piston crown faces to the right.



Drill oil bore (1).
 A = 6 mm (0.236") diameter.
 Deburr bore at both ends.
 Ream out bush with a reamer.
 B = 22.005 ... 22.010 mm
 (0.8663 ... 0.8665")

11-50/25



Replacing Connecting Rods:

Note

Only connecting rods of the same weight class (die-stamped in bearing cap) may be installed in one engine.

Only connecting rods of weight class B5 are available for replacements. They cover the entire weight tolerance range.

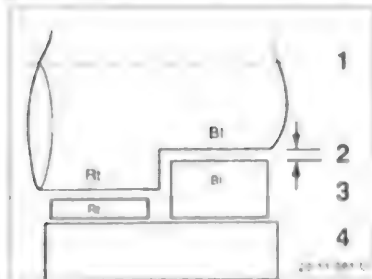


Replacing Conrod Bearing Shells

Select new bearing shells to match the color code on the connecting rod.

Important!

Check ground size of crankshaft - also refer to "Replacing Crankshaft".



Color Code - Shaft Diameter - Bearing Thickness* - Survey

Double Classification Color Codes

Rt = Red

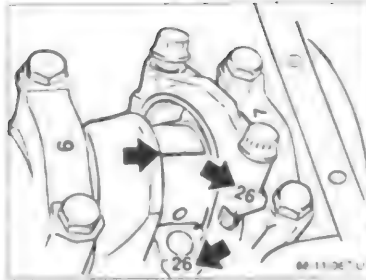
Bl = Blue

1 - Crankpin

2 - Bearing play

3 - Bearing shell thickness

4 - Big conrod end



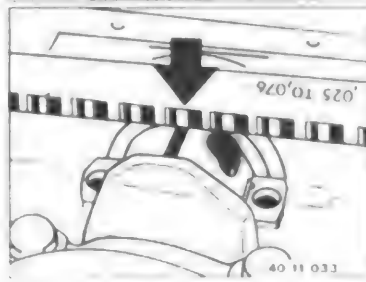
Installation

Check conrod bearing play (only carried out for control purpose)

Place Type PG 1 Plastigage** on crankshaft wiped clean of oil with pistons in BDC position. Mount bearing cap and tighten old conrod bolts to specified torque.

Important!

Do not turn connecting rods or crankshaft.

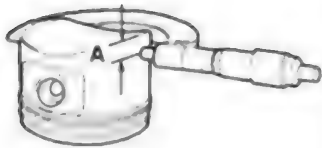


Remove bearing cap and read bearing play (specification: 0.020 ... 0.055 mm) from supplied scale by measuring width of the flattened Plastigage. Correct the bearing play by installing new bearing shells or bearing shells with different color code.

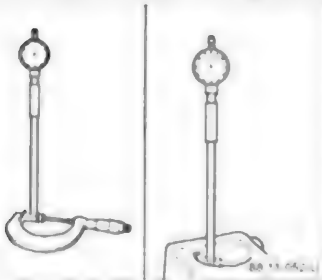
* Refer to Specifications

** Source of Supply: Cartool

11-50/26



88 11 051 U



88 11 052 U

o Checking / Replacing Pistons:

Installation:

Measure installed piston clearance before installing. Measure piston diameter with a micrometer at distance A* from the lower edge of the piston and offset 90° from the piston pin axis.

Set internal caliper to zero on the micrometer with the measured piston diameter. Measure cylinder bore diagonally at bottom, middle and top.

New piston clearance: 0.01 ... 0.04 mm
Max. wear clearance: 0.15 mm

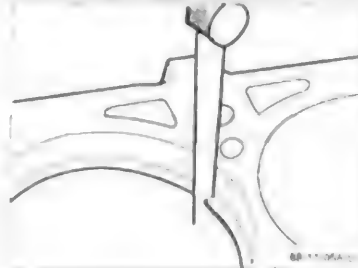


70 11 067 M

Measure side clearance

Specifications:

Groove 1 = 0.020 ... 0.052 mm
Groove 2 = 0.020 ... 0.052 mm
Groove 3 = 0.020 ... 0.055 mm



88 11 054 U

Measure end clearance

Specifications:

Groove 1 = 0.20 ... 0.40 mm
Groove 2 = 0.20 ... 0.40 mm

o Checking / Replacing Piston Rings:

Remove piston rings with a piston ring compressing pliers.

Note:

It might not be possible to find the identification on used piston rings. Lay piston rings aside in correct sequence and installed position.

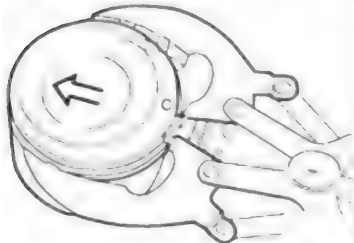
Installation:

Install piston rings with the word "TOP" facing the piston crown.

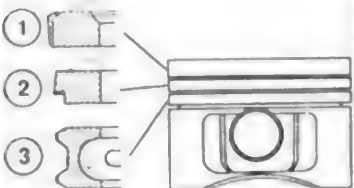
- 1 Plain compression ring
- 2 Tapered face compression ring
- 3 Oil scraper ring with rubber lined spring

Offset piston ring gaps by approx. 120° to each other, but not above the piston pin bore.

• See Specifications

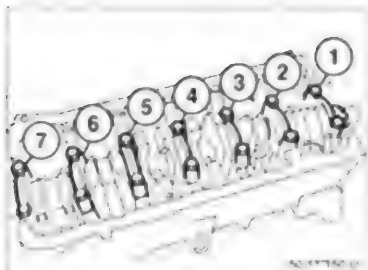


70 11 065 U



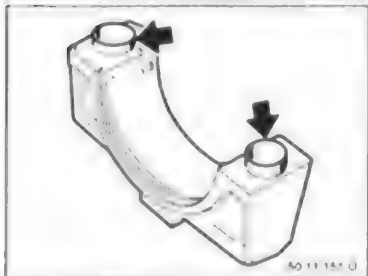
50 11 156 U

11-50/27

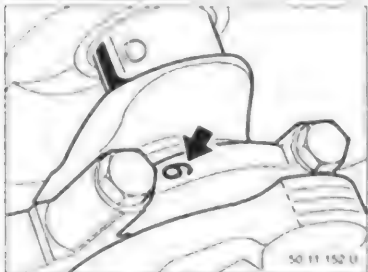


• Removing Crankshaft (Replacing Crankshaft - see 11 21 501)

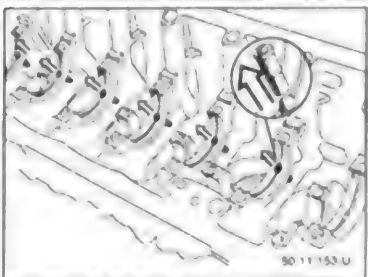
Remove bearing caps (1 ... 7) and lift out crankshaft



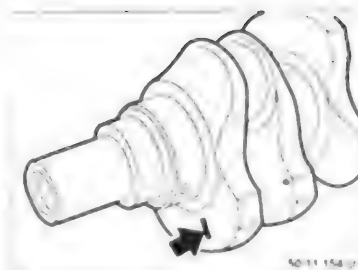
Installation
Check dowel sleeves.



Installation
Bearing caps are marked with a cast 1 ... 7 on the "exhaust side"



Installation
Make sure that oil spray jets are inserted in bearings 2 ... 7.



Installation
Lubricate bearing shells with oil
Install crankshaft
Mount bearing caps 1 ... 7 in such a manner that grooves of bearing shell guides are on one side.
Align bearing caps precisely

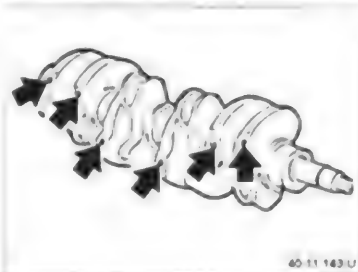
Note
Thrust bearing shells are installed only for bearing no. 6.



Bearing Cap Tightening Procedures:

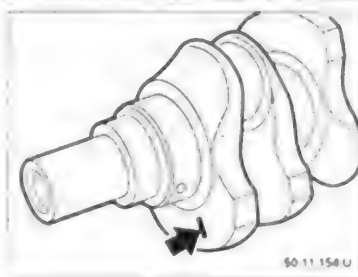
Tighten bolts (washed and lubricated with oil) in two steps

Step 1 = 23 Nm (17 ft. lbs.) torque
Step 2 = 50° torque angle



• Replacing Main Bearing Shells

The crankshaft is marked with yellow, green or white paint depending on main bearing journal tolerances.

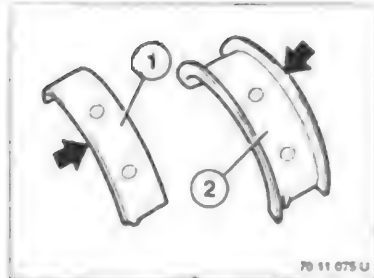


Important!
Check ground size* of the crankshaft

1 paint stripe = size 1 (0.25 mm 0.010")
2 paint stripes = size 2 (0.50 mm 0.020")

• See Specifications

11-50/28

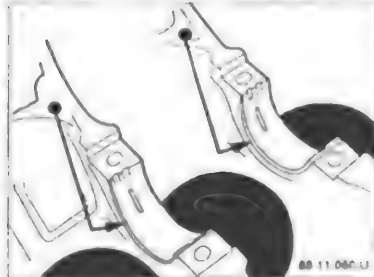


70 11 075 U

Bearing shells are marked with yellow, green or white paint.

- 1 = Bearing shell
- 2 = Thrust bearing shell

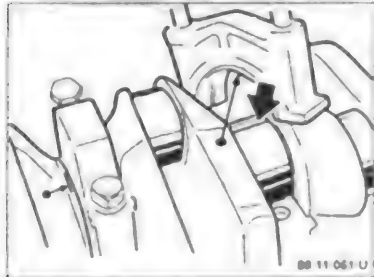
Check ground size of main bearing journals.



80 11 080 U

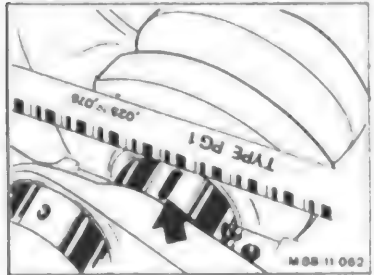
Install bearing shells in crankcase with same color code as dot of paint on the crankcase.
Install bearing shells in bearing caps with same color code as on the crankshaft.

Install both bearing shells with the color code of the crankshaft, if the paint mark has been washed off of the crankcase.



80 11 081 U

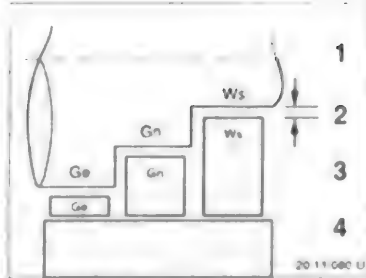
Install crankshaft.
Place Type PG-1 Plastigage** on the crankshaft wiped clean of oil and tighten bearing caps as specified.
Tightening torque*.
Don't turn the crankshaft.



M08 11 062

Remove bearing caps and read bearing play* by measuring the width of the flattened Plastigage with help of the supplied scale.
Install new bearing shells or bearing shells with a different color code to correct the bearing play.

- * See Specifications
- ** Source of Supply: CARTOOL



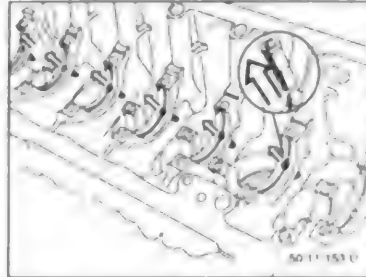
20 11 080 U

Survey of Color Code/Shaft Diameter Bearing Shell Thickness*

Triple Classification Color Codes:

- Ge = Yellow
- Gn = Green
- Ws = White

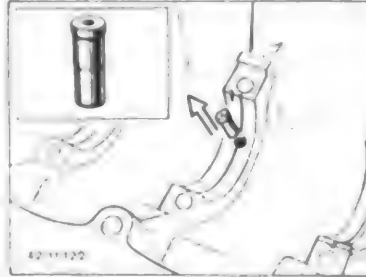
- 1 Crankshaft diameter
- 2 Bearing play
- 3 Bearing shell thickness
- 4 Bearing support diameter



50 11 153 U

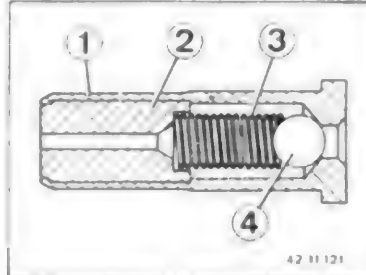
Replacing Spray Jets in Crankshaft Bearing Supports

Note
Spray jets are installed in bores of bearing supports 2 ... 7 and supply oil for lubrication of the piston pins and cooling of pistons.



42 11 120

Pull spray jet out of bore

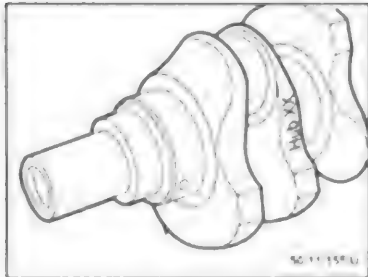


42 11 121

Spray Jet Assembly:

- 1 = Jet body
- 2 = Jet
- 3 = Spring
- 4 = Ball

11-50/29

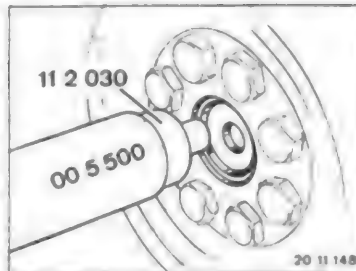


11 21 501 REPLACING CRANKSHAFT - Crankshaft Removed -

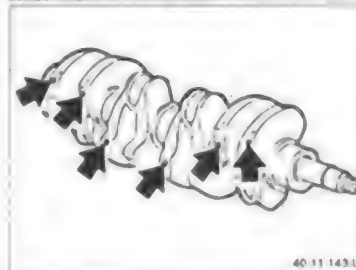
Notes:
Replacement crankshafts are supplied complete with corresponding main and conrod bearing shells.

Crankshaft Identification (Cast on Crank Cheek):

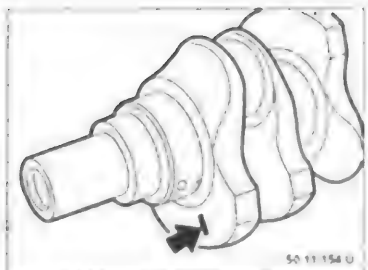
Engine	Stroke
M50 B20	66 mm (2.598")
M50 B25	75 mm (2.953")



Drive in pilot bearing with Special Tools 11 2 030 and 00 5 500.

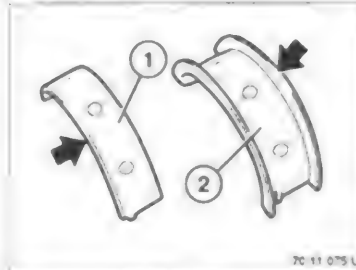


Crankshafts are marked with yellow, green or white paint depending on the main bearing journal tolerances.



Crankshafts are surface treated and may only be reground in the factory. Reground crankshafts are marked with stripes of paint*.

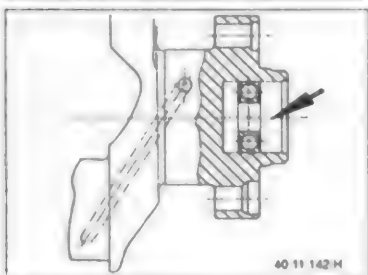
1 paint stripe = size 1 (0.025 mm / 0.010")
2 paint stripes = size 2 (0.50 mm / 0.020")



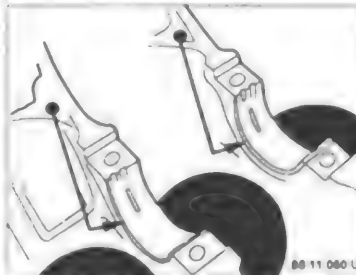
Bearing shells are marked with yellow, green or white paint.

1 = Bearing shell 1-2-3-4-5-7
2 = Bearing shell 6 (thrust bearing)

Check ground size of main bearing journals!



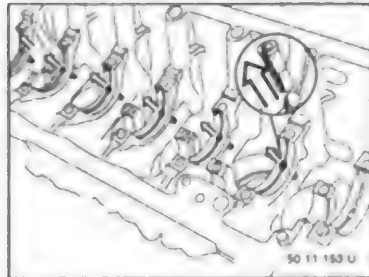
Cars with Manual Transmission:
Install pilot bearing for transmission main shaft.



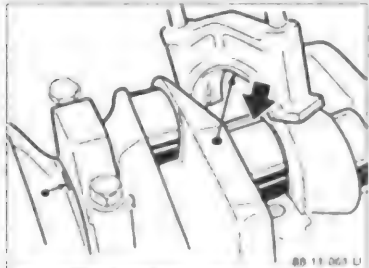
Installing Procedure:
Only place bearing shells with "yellow" color code in the crankcase (regardless of paint mark still on the crankcase). Install bearing shells in bearing caps depending on color code of crankshaft bearing journal (yellow, green or white).

* See Specifications

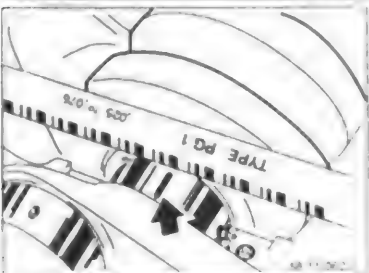
11-50/30



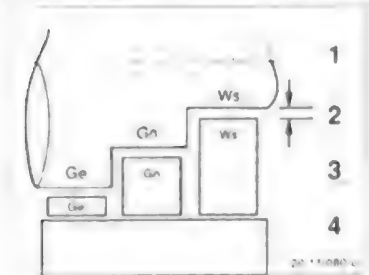
Installation:
Make sure that oil spray jets are inserted for bearings 2 ... 7.



Install crankshaft.
Place Type PG-1 Plastigage** on crankshaft wiped clean of oil and tighten bearing caps as specified.
Tightening torque*.
Don't turn the crankshaft.



Remove bearing caps
Read bearing play* by measuring width of the flattened Plastigage with help of the supplied scale.
Install new bearing shells, bearing shells of different machined size or bearing shells with a different color code to correct the bearing play.



Survey of Color Code/Shaft Diameter/Bearing Shell Thickness*

Triple Classification Color Codes:
Ge = Yellow
Gn = Green
Ws = White

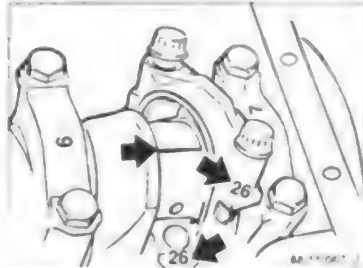
- 1 Crankshaft
- 2 Bearing play
- 3 Bearing shell thickness
- 4 Bearing support

* See Specifications
** Source of Supply: CARTOOL

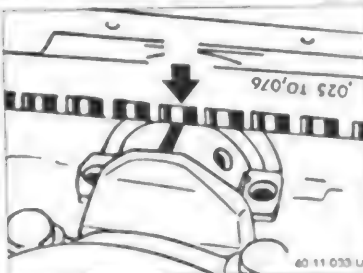


Replacing Conrod Bearing Shells:
Red or blue conrod bearing shells are installed standard depending on the paint mark on the connecting rod for a pertinent crankshaft ground size.

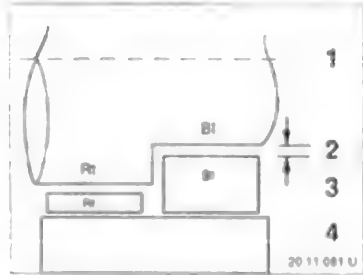
Only install red bearing shells in the pertinent ground size for replacement of the crankshaft.



Installation
Check conrod bearing play
Place Type PG-1 Plastigage** on crankshaft wiped clean of oil in BDC position. Mount bearing caps and tighten with old conrod bolts as specified.



Important!
Don't turn the connecting rod or crankshaft
Remove bearing caps and read bearing play by measuring width of the flattened Plastigage with help of the supplied scale
Specification: 0.020 ... 0.055 mm
(0.0008 ... 0.0022")
Install new bearing shells or bearing shells with a different color code to correct the bearing play.



Survey of Color Code/Shaft Diameter/Bearing Shell Thickness*

Double Classification Color Codes:
Rt = Red
Bl = Blue

- 1 Crankshaft journal
- 2 Bearing play
- 3 Bearing shell thickness
- 4 Conrod end

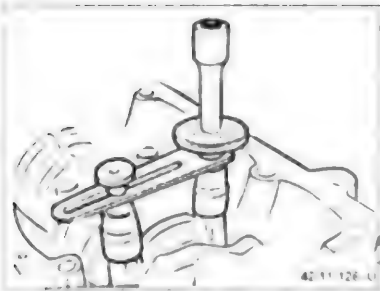
* See Specifications
** Source of Supply: CARTOOL

11-50/31

Main Bearing Cap Bolt Tightening Procedure:

Tighten bolts (washed and lubricated with oil) in two steps.

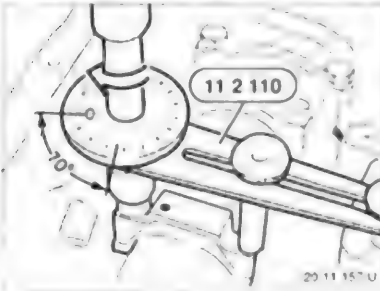
Step 1 = 23 Nm (17 ft. lbs.) torque
Step 2 = 50° torque angle



Conrod Bearing Cap Bolt Tightening Procedure:

Lubricate conrod bearing shells with oil and mount bearing caps that pair numbers are opposite each other. Use new conrod bolts. Tighten conrod bolts in two steps.

Step 1 = 23 Nm (17 ft. lbs.) torque
Step 2 = 70° torque angle



11 Engine M50 VANOS

11 00 603	Engine – disassemble and assemble (engine removed)	11- 50/40
	Cylinder head – remove and install	11- 50/40
	Engine – mount on assembly stand	11- 50/40
	Thermostat housing cover – remove and install	11- 50/41
	Cylinder head cover – remove	11- 50/42
	VANOS control unit – remove	11- 50/43
	Cylinder head – unscrew	11- 50/46
	Camshaft adjusting procedures	11- 50/47
	VANOS – check function	11- 50/53
	Cylinder head – disassemble and assemble	11- 50/54
	Cylinder head – mount on assembly stand	11- 50/54
	Camshafts – replace	11- 50/55
	Valves – remove	11- 50/57
	Survey of repair-size valves	11- 50/57
	Check valve – remove	11- 50/58
	Cylinder head – check for cracks in water test	11- 50/59
	Cylinder head – machine sealing surface	11- 50/59
	Cylinder head – inspect sealing surface	11- 50/59
	Cylinder head – machine	11- 50/59
	Valve guide and seat – machine	11- 50/60
	Valve guide – ream	11- 50/60
	Valve seat – machine	11- 50/60
	Crankcase – disassemble and assemble	11- 50/61
	Alternator – remove	11- 50/61
	Tensioning roller and console – remove	11- 50/61
	Oil filter body – remove	11- 50/62
	Water pump – remove	11- 50/62
	Vibration damper – remove	11- 50/63
	Vibration damper hub – remove	11- 50/63
	Front end radial oil seal – replace	11- 50/63
	Oil pan – remove	11- 50/64
	Lower timing case cover – remove	11- 50/64
	Timing chain and guides, lower – remove	11- 50/65
	Oil pump – remove (E34)	11- 50/65
	Oil pump – remove (E36)	11- 50/66
	Oil pump – disassemble	11- 50/67
	Connecting rod and piston – remove	11- 50/68
	Connecting rod – remove	11- 50/69
	Connecting rod bearing shells – replace	11- 50/70
	Piston – replace	11- 50/70
	Piston rings – replace/check	11- 50/71
	Clutch / flywheel – remove	11- 50/72
	Pilot bearing in crankshaft – replace	11- 50/73
	Rear end cover – remove	11- 50/73
	Crankshaft – remove	11- 50/74
	Piston cooling spray jets – replace	11- 50/75
	Main bearing shells – replace	11- 50/76

11-50/40

11 00 603 DISASSEMBLING AND ASSEMBLING ENGINE - Engine Removed -

General Information on Valve Timing Work

If work had been carried out on the cylinder head, for which the camshaft was removed, there must be compliance with the following.

Hydraulic valve tappets expand without load from the camshaft and require a certain amount of time to be compressed again after installation. Consequently in case of fast installation even the "closed" valves could be opened and touch the pistons.

The following waiting times are necessary between installing of the camshaft and mounting the cylinder head.

Room temp. (20° C)	4 minutes
10 to 20° C	11 minutes
0 to 10° C	30 minutes

After installation of the camshaft and timing chain the engine may first be cranked after the following waiting times.

Room temp. (20° C)	after 10 minutes
10 to 20° C	after 30 minutes
0 to 10° C	after 75 minutes

Working on Valve Train with Installed Cylinder Head:

Turn crankshaft in engine's direction of rotation about 30° from TDC.

In this manner none of the pistons will be in TDC.

Install camshaft that peaks of cams for cylinder no. 1 point to each other.

Keep to the above mentioned waiting times.

Turn crankshaft back to TDC and install the timing chain.

Crank engine for first time 10 minutes after installation of the camshaft.

Disassembling and repairing the engine are described in chronological sequence on the following pages. The list of contents is provided to help take up work again after an interruption or to more easily find a certain point. They only describe direct removal and installation, and do not contain full details of procedures.

If applicable, drain engine oil and fill the engine with new engine oil after assembling the engine.

Check the engine oil level after installation and trial run.

e Removing Cylinder Head

Remove intake manifold together with throttle valve.

This step will have already been carried out on engines which have been removed from the car.

Refer to Group 11 in Model Repair Manual.

e Mounting Engine on Assembly Stand

Remove exhaust manifolds.

Unscrew nuts.

Lift off exhaust manifolds.

Installation

Shorter manifold is located at rear.

Replace nuts.

Coat threads with copper paste**.

Tightening torque*.

Installation

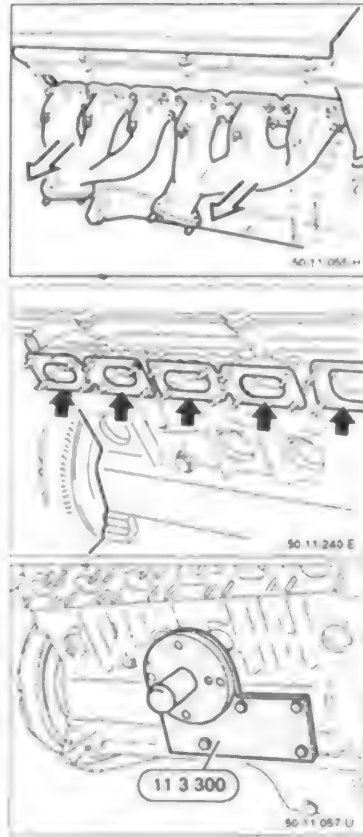
Replace gaskets.

Install gaskets that beads face exhaust manifolds.

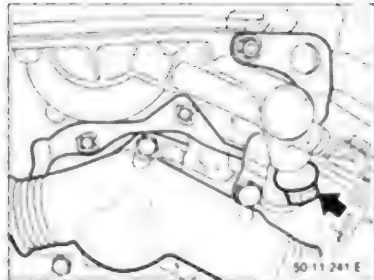
Mount engine on Special Tool 00 1 490 using Special Tool 11 3 300.

* Refer to Specifications.

** Source of Supply: BMW Parts.



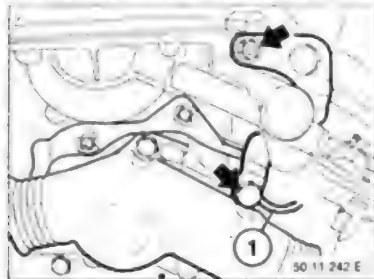
11-50/41



Unscrew oil pipe at VANOS control unit

Installation:

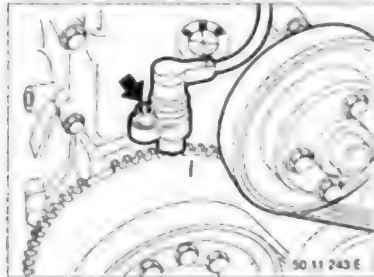
Check seals, replacing them if necessary.
Tightening torque*.



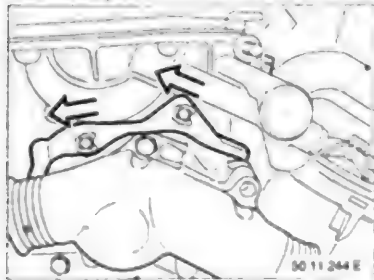
Unscrew suspension eye.

Installation:

Check for ground strap (1).

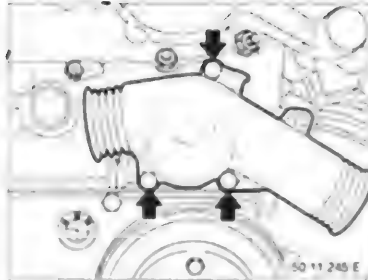


Unscrew pulse sender.



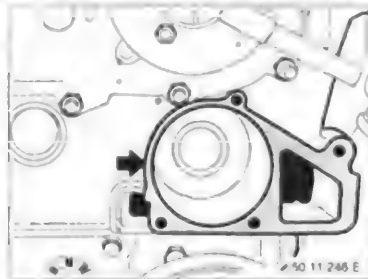
Remove wiring duct for pulse sender.

* Refer to Specifications



o Removing Thermostat Housing Cover

If applicable, unscrew thermostat housing for other work on cylinder head later.



Installation:

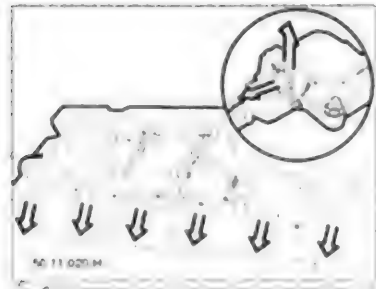
Sealing surfaces must be clean and without oil.
Check rubber profile gasket, replacing it if necessary.



Installation:

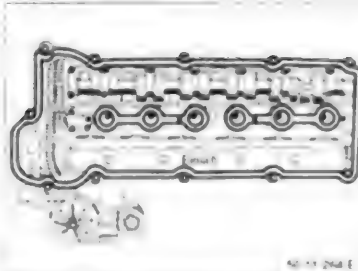
Check installed direction.
Vent or arrow faces up.
Replace seal.

11-50/42



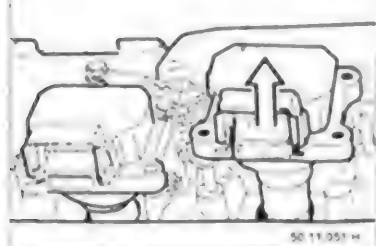
6 Removing Cylinder Head Cover

If applicable, pull plugs off of ignition coils



Installation

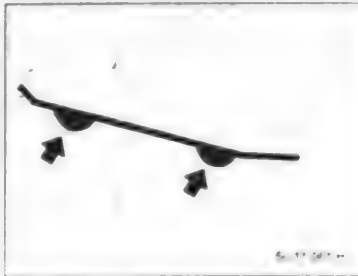
Check cover gasket, replacing it if necessary.
Place outer and inner cover gaskets on cylinder head in advance.



Unscrew nuts.
Remove ignition coils.

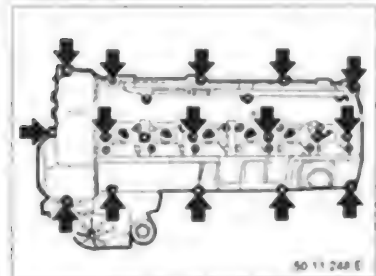
Installation

Check for ground strap of ignition coils at cylinders 3 and 6.



Installation

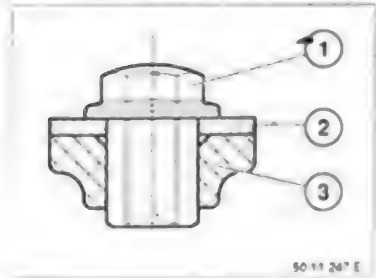
Check for correct seating of gasket on back of the cylinder head when mounting the cylinder head cover.



Unscrew cylinder head cover

Installation

Install and align cover.
Screw on cover nuts, but do not tighten them.
Tighten cover nuts diagonally from inside to outside.
Tightening torque*.



Note:

Cylinder head cover is separated from the cylinder head as far as transmission of oscillation is concerned by employing rubber mounts and gaskets.

Check arrangement of cover installation.

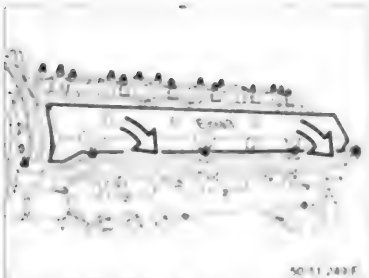
- 1 Cover nut
- 2 Washer
- 3 Rubber mount

* Refer to Specifications

11-50/43

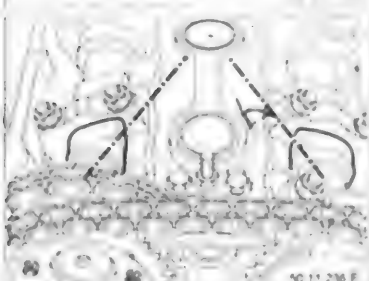
o Removing VANOS Control Unit

Take off plastic cover.
Lift out lock and remove plastic cover for the intake camshaft.



50 11 249 F

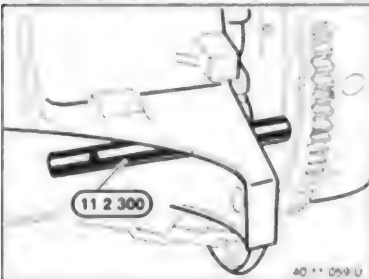
Turn engine in its direction of rotation until the peaks of cams on intake and exhaust camshafts for cylinder no. 1 point to each other.



50 11 236 F

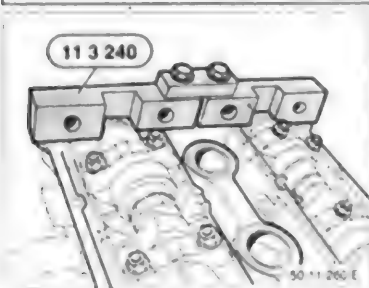
Hold crankshaft in TDC using Special Tool 11 2 300.

Important!
Remove special tool before operating the engine.

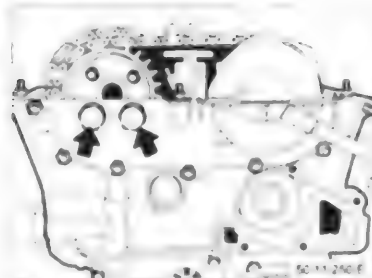


40 11 059 U

Hold camshafts using Special Tool 11 3 240.



50 11 260 E



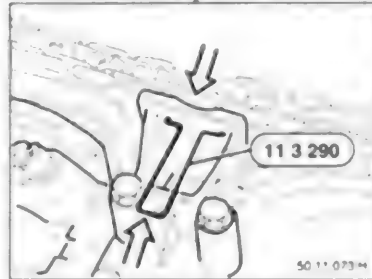
Screw plugs out of control unit

50 11 250 F



50 11 251 E

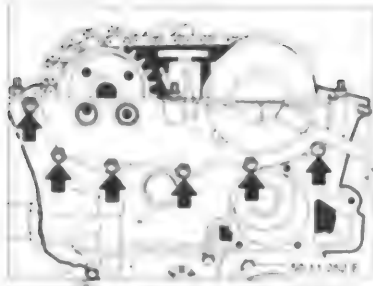
Unscrew bolts of sprocket on the exhaust camshaft



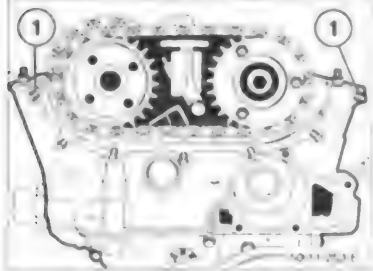
50 11 073 H

Press down on upper chain tensioner and lock using Special Tool 11 3 290.

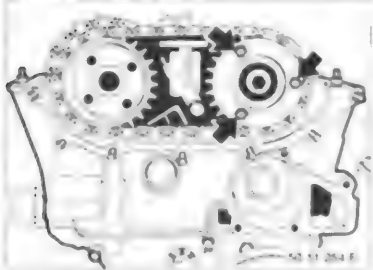
11-50/44



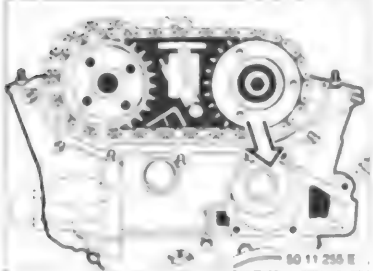
Unscrew nuts.
Remove VANOS control unit.



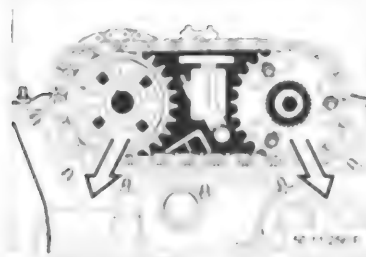
Installation:
Check for dowel sleeves (1).
Apply 3 Bond 1209** liquid sealing compound at the corners of the joint between the cylinder head and VANOS control unit.
Replace gasket.



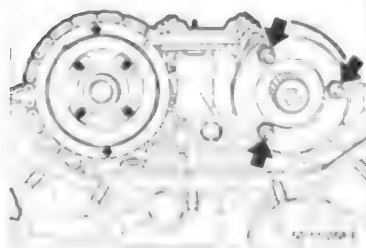
Unscrew nuts of intake camshaft.



Remove thrust washer.

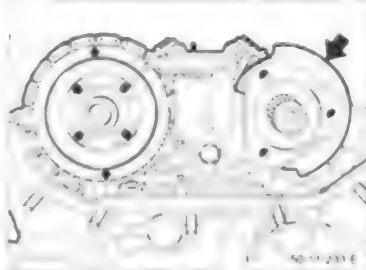


Remove sprockets together with chain.



If applicable for other work on cylinder head later, unscrew thrust washer bolts.
Remove thrust washer.

Installation:
Tightening torque*.

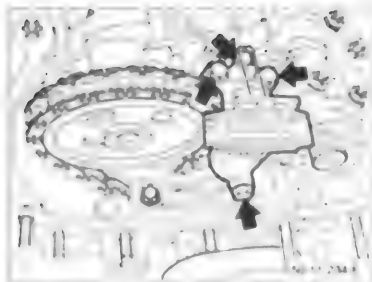


If applicable, remove sender gear.

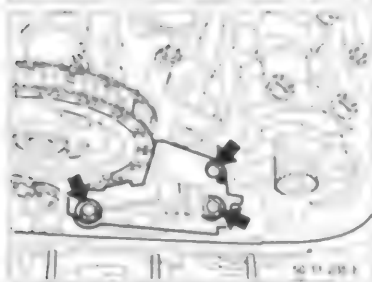
** Source of Supply: BMW Parts

* Refer to Specifications

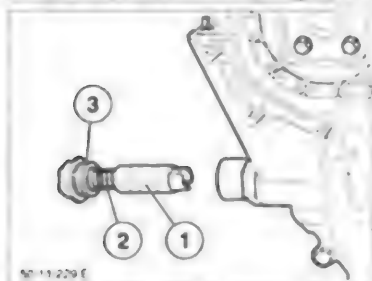
11-50/45



Unscrew secondary tensioner.



Unscrew chain guide.



Unscrew bolt (3).

Caution!
Strong spring force.

Remove spring (2) and plunger (1).

Installation

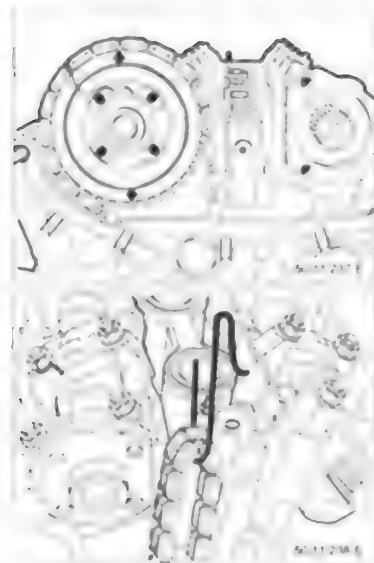
Insert chain tensioner plunger (1) in such a manner that guides engage in the tensioning rail.

Install spring (2) and bolt (3).

Replace seal.

Tightening torque*.

* Refer to Specifications.



Lift off sprocket together with chain.

Note:
Secure chain with a piece of wire to keep it from sliding down.

11-50/46

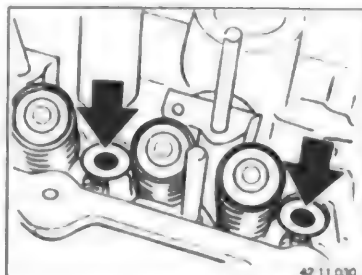


50 11 500 U

o Unscrewing Cylinder Head

Important:

If applicable, first turn crankshaft in engine's direction of rotation about 30° away from TDC and then back to TDC only after turning the camshaft. This measure ensures that valves do not contact piston crowns.



42 11 030

Note:

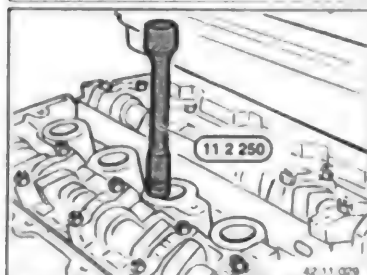
Washers are sometimes punch-locked in standard production cylinder heads to prevent them from getting lost. Use new washers without punch-locking when installing a new cylinder head. Ensure that no washers are missing.

Unscrew timing case cover to cylinder head bolts



50 11 500 U

unscrew cylinder head bolts from outside to inside in several steps using Special Tool 11 2 250
Lift off cylinder head.



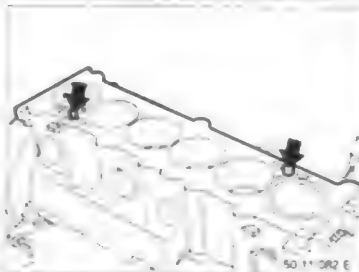
42 11 020

Installation:

Keep to the waiting times for hydraulic valve tappets when installing the cylinder head — refer to "General Information".

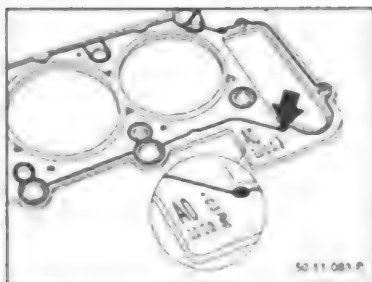
Installation:

Clean sealing surfaces on cylinder head and crankcase, if necessary removing bits of gaskets using a hard wood scraper and watching out that bits of gaskets do not fall into oil and coolant bores. Install new cylinder head gasket. Check dowel sleeves for damage and correct installation.



50 11 082 E

11-50/47



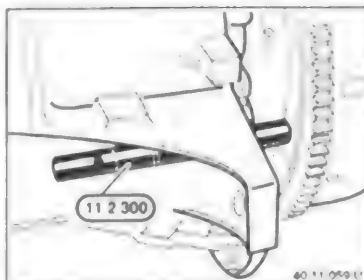
Installation

A 0.3 mm thicker cylinder head gasket is available for machined (ground) cylinder heads (refer to "Checking / Machining Cylinder Head Sealing Surface").

Identification

2.0 for 2.0 liters
2.5 for 2.5 liters

• 0.3 for 0.3 mm thicker gasket after grinding cylinder head

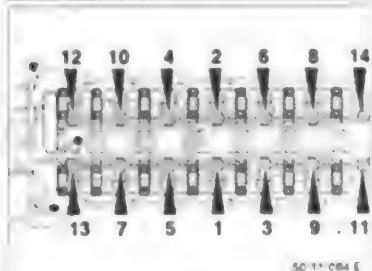


Camshaft Adjusting Procedures

Hold crankshaft in TDC using Special Tool 11 2 300

Important!

Remove special tool before operating the engine.



Installation

Mount cylinder head and tighten new bolts (lightly lubricated with oil) in sequence of 1...14 in three steps. Check cylinder head bolt tightening specifications.

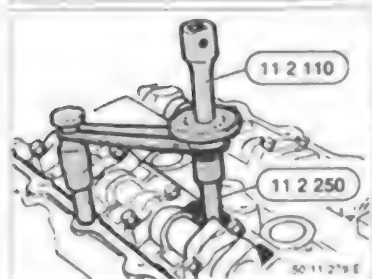
Important!

Cylinder head bolts may only be used once. Keep oil out of tapped bores in crankcase and timing case cover (danger of cracking block, falsified torque values).



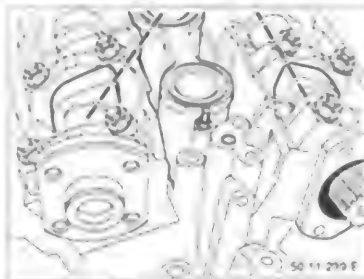
Important!

If the camshaft adjustment has to be corrected so much that valves in cylinders 1 and 6 are moved, first turn the crankshaft in engine's direction of rotation about 30° away from TDC and then back to TDC only after turning the camshaft. This measure prevents contact between valves and piston crowns.



Note

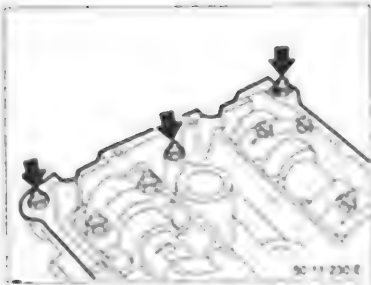
Use Special Tools 11 2 250 and 11 2 110 or 00 9 120 to tighten bolts to torque angle.



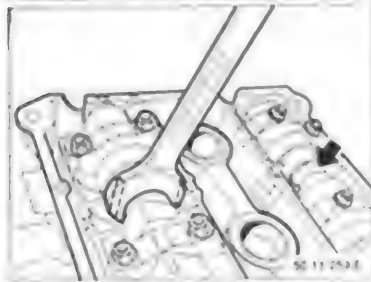
Turn camshaft until peaks of intake and exhaust cams in cylinder no. 1 point to each other.

• Refer to Specifications

11-50/48

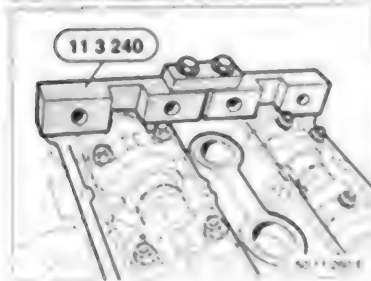


Unscrew and remove the three rear valve cover mounting studs.

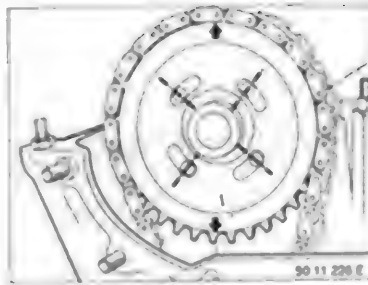


Align camshafts by turning on the hexagon.

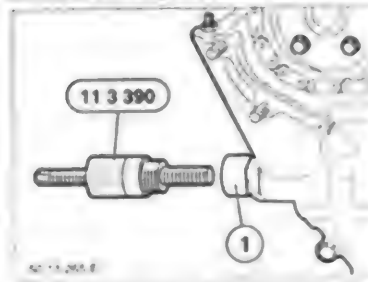
Important:
Don't damage the cylinder head.
If applicable, machine the open-ended wrench accordingly.



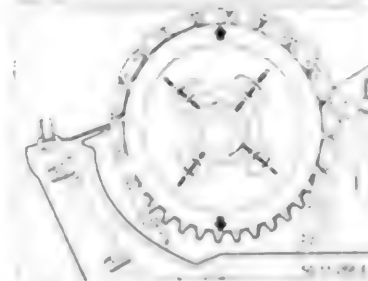
Apply Special Tool 11 3 240 on camshafts at cylinder no. 6.



Install primary timing chain on sprocket and center on the exhaust camshaft. Arrow on sprocket points up. Mount sprocket in such a manner that tapped bores are on the left-hand side of the slots, as the sprocket will be turned to the left when installing the chain tensioner.

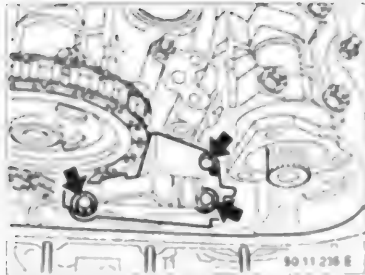


Insert Special Tool 11 3 390 into chain tensioner sleeve (1). Screw in adjusting screw on tensioning rail as far as stop, but do not tighten.

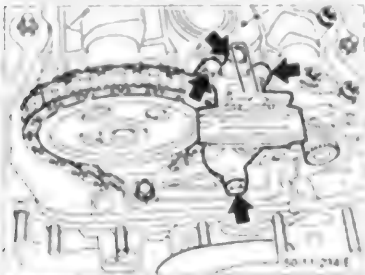


Note:
Sprocket slots are now centered.

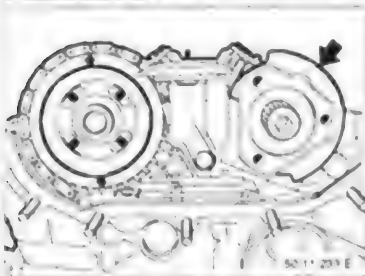
11-50/49



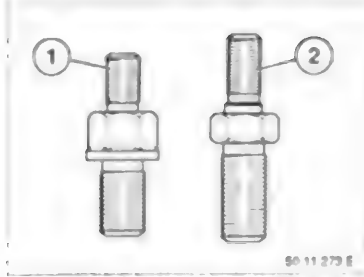
Install chain guide.



Install secondary tensioner



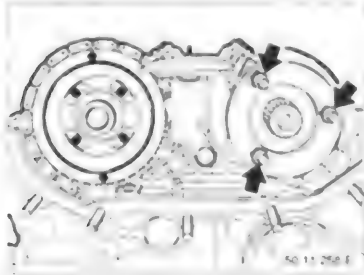
Mount sender gear on the intake camshaft.



90 11 279 E

Important!
Don't mix up studs.

- 1 Stud for cylinder head cover installation
- 2 Stud for thrust washer and sprocket installation



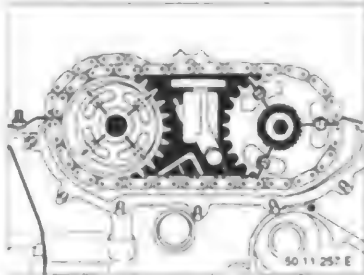
90 11 258 E

Mount thrust washer and secure with studs (2)
Tightening torque:



90 11 347 E

Important!
Mount the intake camshaft sprocket correctly — flat side faces VANOS control unit and collar faces camshaft.

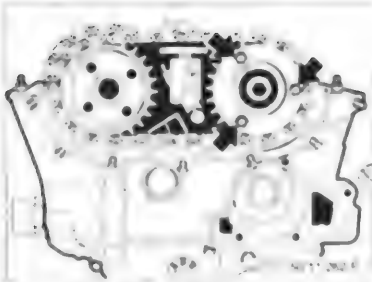


90 11 257 E

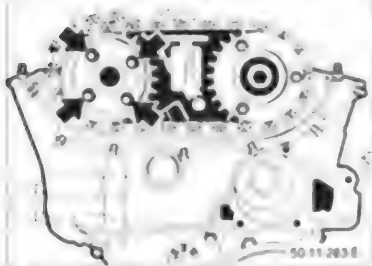
Install both sprockets together with chain.
Arrow on exhaust camshaft sprocket points up.
Slots are then centered.

• Refer to Specifications

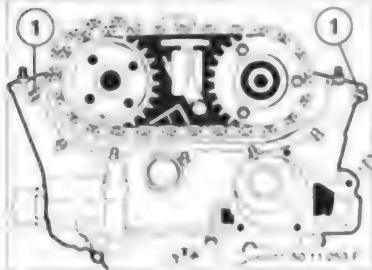
11-50/50



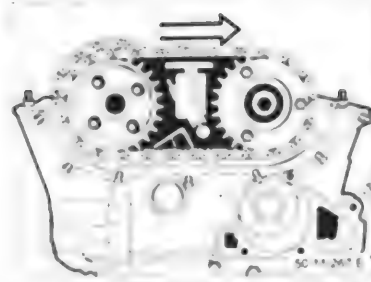
Mount thrust washer on intake camshaft and secure with nuts.
Tightening torque*.



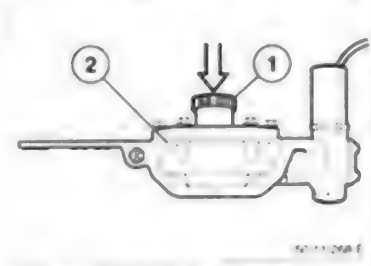
Mount thrust washer on exhaust camshaft using bolts.
Screw in bolts to be free of play, but do not yet tighten them.



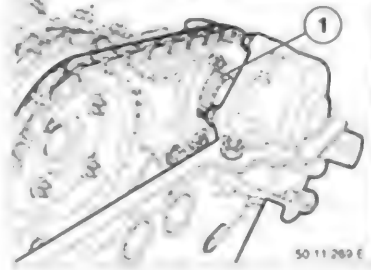
Installation
Check for dowel sleeves (1).
Apply 3 Bond 1209** liquid sealing compound on corners of joint between cylinder head and VANOS control unit.
Replace gasket.



Important!
Before installing the VANOS control unit, turn the sprockets together with secondary chain as far as right-hand stop until slots are aligned with the studs.



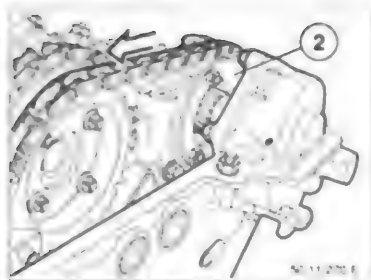
Important!
Before mounting the VANOS control unit, push back splined shaft together with hydraulic plunger (1) in direction of housing (2) as far as stop.



Installation
Mount VANOS control unit.
Turn splined shaft (1) until splines mesh.

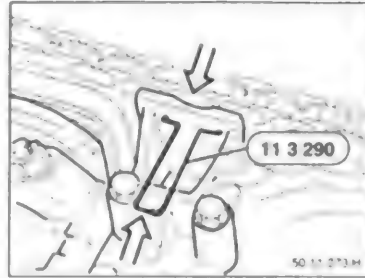
* Refer to Specifications
** Source of Supply: BMW Parts

11-50/51

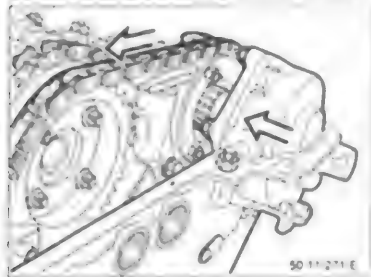


Turn chain together with sprockets counterclockwise by hand until the splined shaft meshes in the splines of sprocket (2).

Important!
It is absolutely essential to ensure that the "FIRST" suitable tooth meshes.

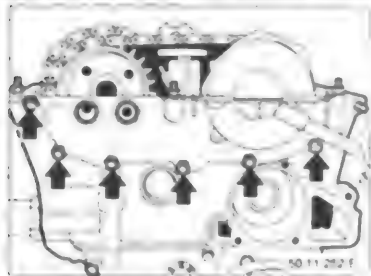


Unlock secondary tensioner

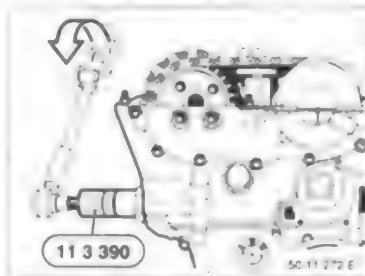


Push VANOS control unit in direction of the cylinder head.
Guiding the bevel splined shaft into the bevel splined sprocket causes the chain together with sprockets to be turned counterclockwise.
Guide chain together with sprockets counterclockwise by hand.

Note
It is absolutely necessary to pull the chain into the root of teeth on the sprockets for timing diagram adjustments since introduction of rubber-lined sprockets.



Tighten VANOS control unit



Preload the tensioning rail with 1.3 Nm torque using Special Tool 11 3 390 by turning the adjusting screw using Special Tool 00 2 050 or a standard torque wrench.

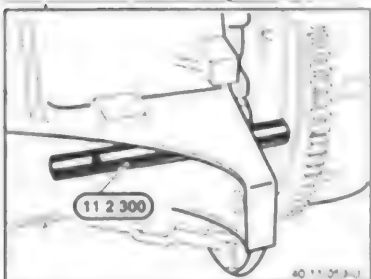
11-50/52



Tighten bolts of exhaust camshaft sprocket in two steps as specified.
Tightening torque*

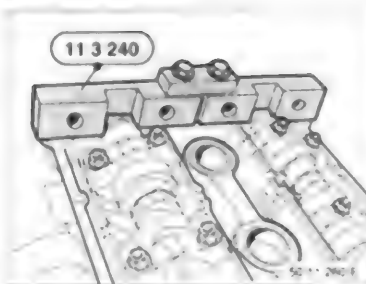


50 11 500 U



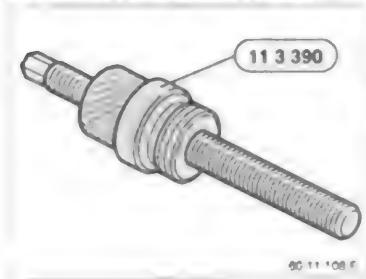
Hold crankshaft in TDC using Special Tool 11 2 300

Important!
Do not crank engine back again.
Remove special tool before operating the engine.



Check adjustment of camshafts.
Apply Special Tool 11 3 240 on camshafts at cylinder no. 6.

Note
Special Tool 11 3 240 must bear flat on cylinder head without any gaps.

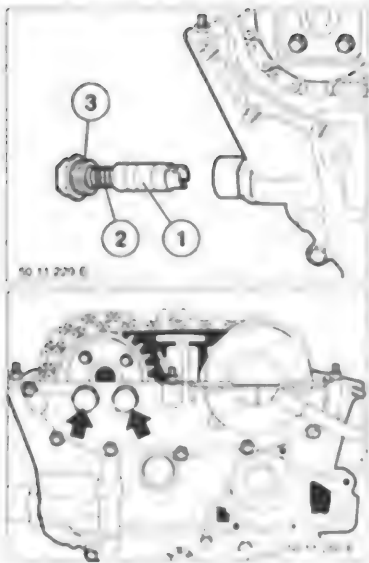


Important!
Always ensure that the timing chain is preloaded with help of Special Tool 11 3 390 when checking the adjustment of camshafts.

Remove Special Tool 11 3 240 from the cylinder head.
Loosen Special Tool 11 3 390.

* Refer to Specifications

11-50/53

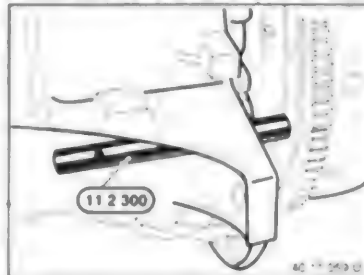
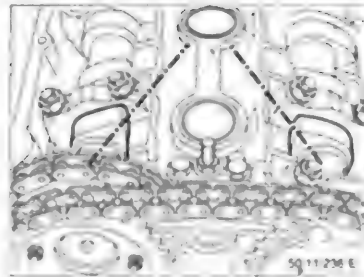


Insert chain tensioner plunger.

Installation
Install chain tensioner plunger (1) that guides engage in the tensioning rail.
Install spring (2) and bolt (3).
Replace seal.

Install plugs

Installation
Replace seals.
Tightening torque*.

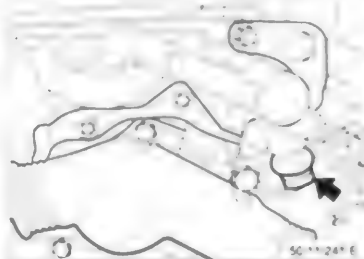


6. Checking Function of VANOS

Crank engine in its direction of rotation until the peaks of intake and exhaust cams in cylinder no. 1 point to each other.

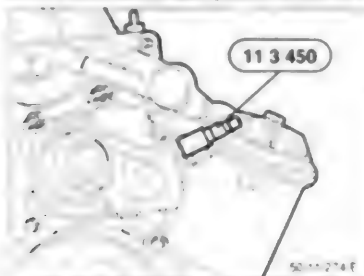
Hold crankshaft in TDC using Special Tool 11 2 300

Important!
Do not crank engine back again.
Remove special tool before operating the engine



Unscrew oil pipe on VANOS control unit

Installation
Check seals, replacing them if necessary.
Tightening torque*.

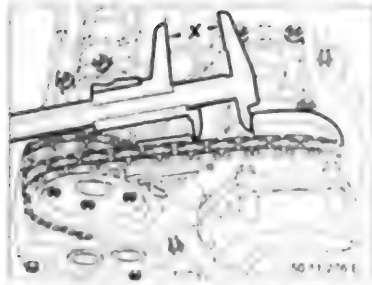


Mount Special Tool 11 3 450 using coupling.
Connect to air pressure supply (2 to 8 bar)

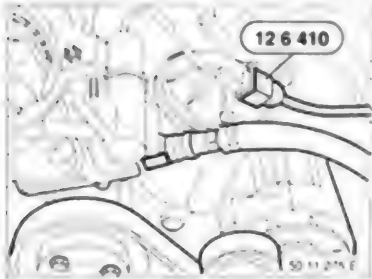
* Refer to Specifications

* Refer to Specifications

11-50/54



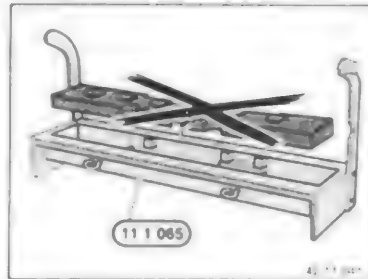
Measure gap between secondary tensioner and edge on the sender gear
Note the value



Connect Special Tool 12 6 410 on 4-way valve for VARIO
Connect battery
Ensure that poles are not mixed up
Camshaft with be adjusted in advanced direction

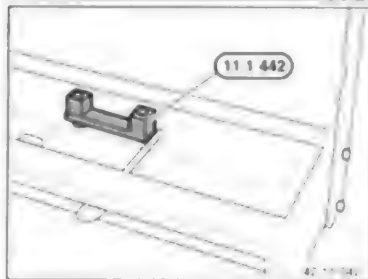


Measure gap between secondary tensioner and edge on the sender gear
Note the value
The difference between both measured values must be at least 8.5 mm

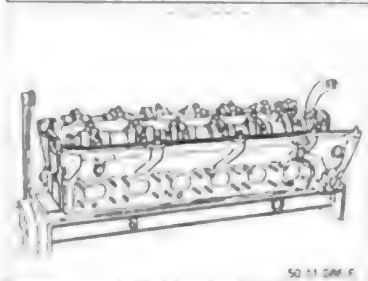


- o Disassembling and Assembling Cylinder Head
- o Mounting Cylinder Head on Assembly Stand

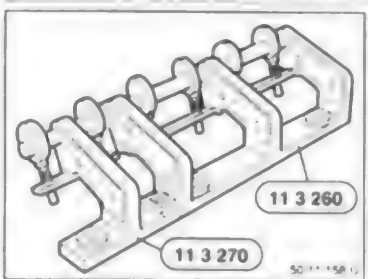
Mount Special Tool 11 1 065 on Special Tool 00 1 490
Do not insert Special Tool 11 1 441 at this time



Note:
Screw Special Tool 11 1 442 on already delivered special tool assembly fixtures



Mount cylinder head on assembly stand fixture using two cylinder head bolts



Prepare Special Tool 11 3 260 for a six cylinder engine

11-50/55

Replacing Camshafts

Important!

Camshafts could be damaged or broken in case of improper removal / installation without application of special tools.
In addition, the valves could be bent through contact with the piston crowns when mounting the cylinder head on the crankcase.
Always conform with procedures and sequence of installation.

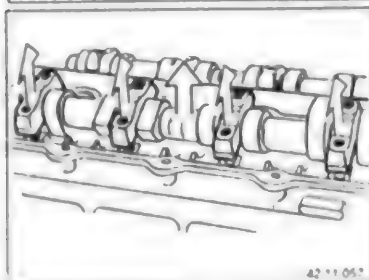


Unscrew spark plugs
Apply Special Tool 11 3 260 and bolt down
in the spark plug tapped bores.
Tightening torque = 23 Nm.



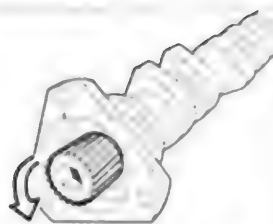
Preload bearing caps by turning the eccentric shaft.
Unscrew all bearing cap bolts.

Installation
Tightening torque*.



Loosen and remove special tool.
Lift out bearing caps and camshaft.

* Refer to Specifications

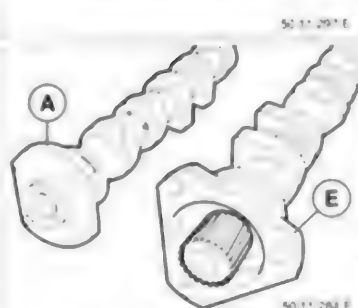


Take splined shaft out of intake camshaft

Note:
Clamp camshaft in a vise fitted with soft jaws

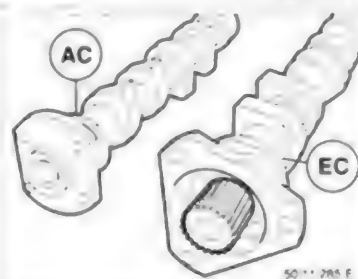
Remove splined shaft

Installation
Tightening torque*.



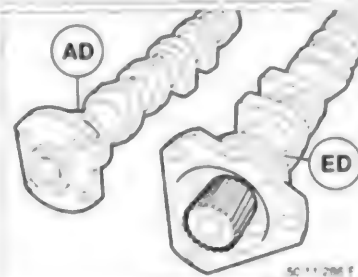
Note:
Identification of camshafts on flange for timing chain sprocket

E = Intake camshaft
A = Exhaust camshaft



Note:
Identification of camshafts

AC = Exhaust camshaft 2.0 liters
EC = Intake camshaft 2.0 liters

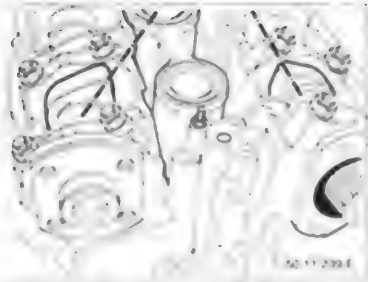


Note:
Identification of camshafts

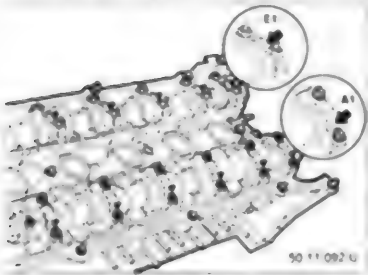
AD = Exhaust camshaft 2.5 liters
ED = Intake camshaft 2.5 liters

* Refer to Specifications

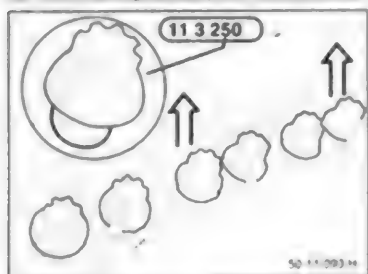
11-50/56



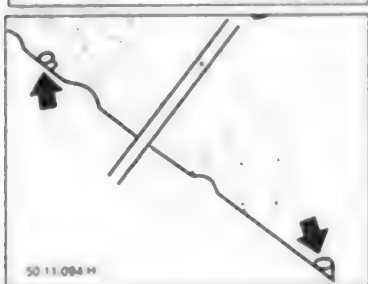
Installation
Install camshafts in such a manner that the peaks of intake and exhaust cams for cylinder no. 1 point to each other.



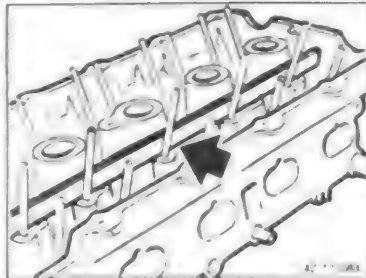
Installation
Bearing caps are marked with A1 ... A7 for the exhaust side or E1 ... E7 for the intake side and these marks can be read from the exhaust side



Hold valve clearance compensators tight using Special Tools 11 3 250
Lift out bearing rail together with valve tappet



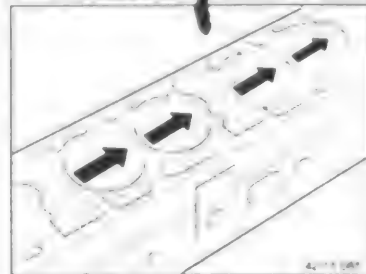
Installation
Check for centering sleeves and studs at bearings 2 and 7.



Note
If a cylinder head is being replaced because of mechanical damage (cracked, distorted), the bearing surfaces of bearing rails on the old cylinder head must be checked for distortion using a steel straightedge.
Max. gap = 0.05 mm.
Also replace the bearing rails in case of greater deviation.



Installation
Bearing rails are marked with "A" for exhaust side or "E" for intake side



Installation
Inspect bearing surfaces of valve clearance compensators for wear (scoring)

11-50/57

● Removing Valves

Install Special Tool 11 1 441 in Special Tool 11 1 065 from underneath and secure with studs.

Screw on Special Tool 11 1 051 (holder). Mount Special Tool 11 1 068 together with Special Tool 11 1 052 and Special Tool 11 1 067.

Press down on valve springs and remove valve collars. Remove valve springs and spring retainers. Take tray out of the assembly stand fixture downwards and pull out valve.

● Survey of Valves for Repairs

Important!

A valve with a thicker valve head must be installed of more than 0.2 mm is machined off of the valve seat (change in compression). The following valve versions are available in addition to standard size valves

Stem Oversize	0.0 mm Size	0.1 mm Oversize	0.2 mm Oversize
Valve head thickness oversize	0.2 mm	0.2 mm	0.4 mm
For machining on seat insert more than mm	0.2 mm	0.2 mm	0.4 mm
Identification on stem (see Figure)	R 0	R 1	R 2

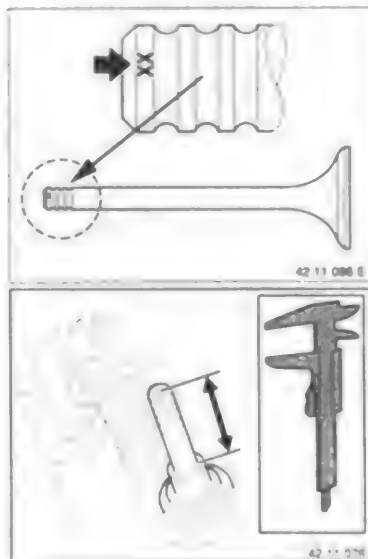
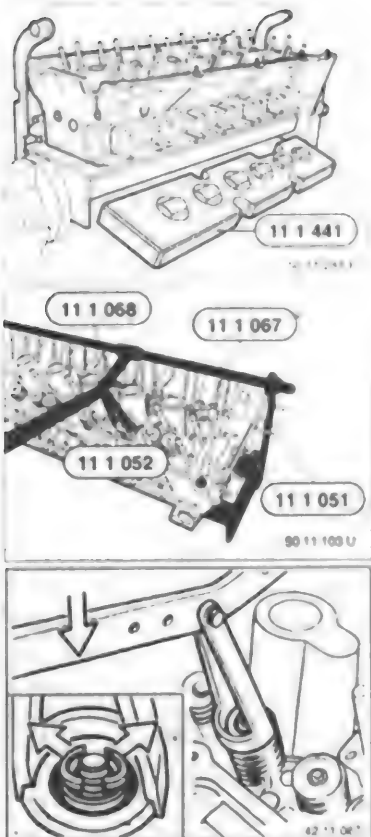
Note for Second Machining

If size "R 0" valve is already installed and valve seat grinding is greater than 0.2 mm, install a size "R 2" valve straight off. Valves with thick valve heads cause engine damage (knock limit is exceeded).

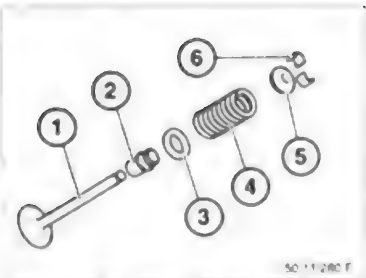
Location of Valve Identification

To which extent the valve seat must be machined can be determined as follows.

Insert valve, measure protrusion from valve stem to valve guide and note value.
Machine valve seat.
Insert same valve again, measure protrusion from valve stem to valve guide and note value.
The difference of both measured values is the machining distance.



11-50/58

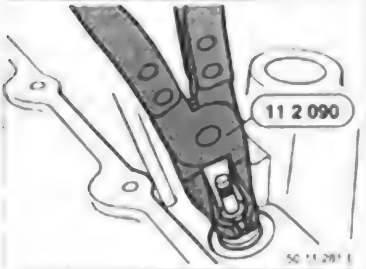


50 11 280 F

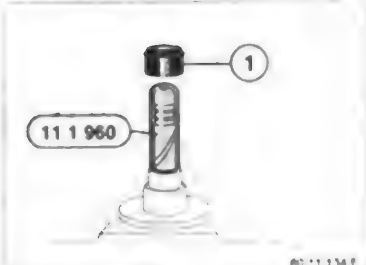
Sequence of Installation

- 1 Valve
- 2 Valve stem seal
- 3 Lower valve spring retainer
- 4 Valve spring
- 5 Upper valve spring retainer
- 6 Valve collets

Pull off valve spring seal using Special Tool 11 2 090



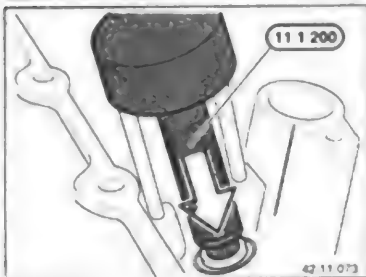
50 11 281 F



60 11 134 E

Installation

Lubricate valve stem with oil and insert valve.
Apply Special Tool 11 1 960.
Lubricate new valve stem seal (1) with oil and install.



42 11 073

Installation:

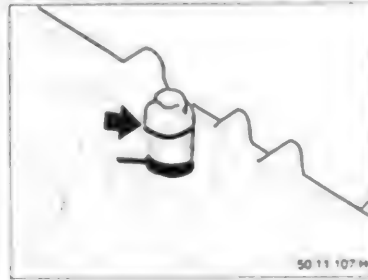
Press on valve stem seal as far as stop by hand using Special Tool 11 1 200.



50 11 108 H

6 Removing Check Valve

Unscrew valve



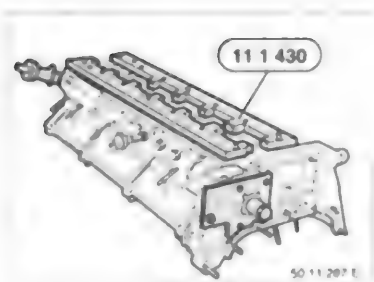
50 11 107 H

Installation

Check seal, replacing it if necessary.
Tightening torque*.

* Refer to Specifications

11-50/59

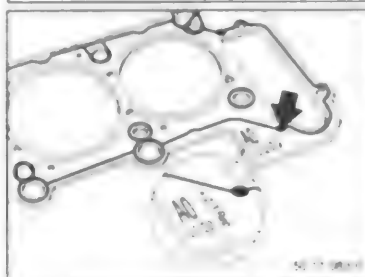
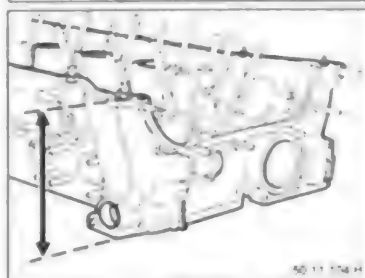
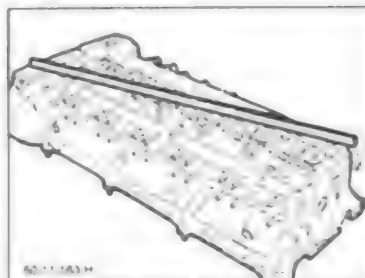


o Checking Cylinder Head for Cracks in Water Test

If there is suspicion of leakage in the coolant circuit (cylinder head zone), check the cylinder head as described below. Plug off the coolant circuit using Special Tool 11 1 430.

Supply air pressure to cylinder head
Testing pressure = 4.5 bar
Place cylinder head in a water bath and check for cracks

Note
If necessary, soften the bath water with a detergent.



o Grinding Cylinder Head Sealing Surface

o Inspecting Cylinder Head Sealing Surface

Check levelness of the cylinder head sealing surface with help of a standard steel straightedge

Max. levelness deviation = 0.03 mm

o Machining Cylinder Head

Remove all attachments from the cylinder head to machine the sealing surface

Maximum machining*:
New cylinder head height*

A 0.3 mm thicker cylinder head gasket is available for repairs to compensate for difference in compression

* Refer to Specifications

11-50/60

• Machining Valve Guide and Seat

To measure, insert a new valve in such a manner that the valve stem end is flush with the valve guide.
Apply dial gage and measure tilt.
Max. permissible tilt:

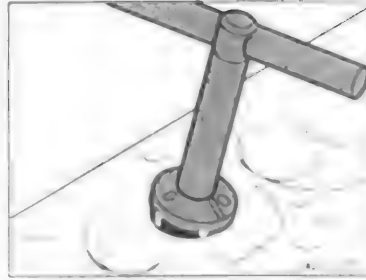
• Reaming Valve Guides

In case of excessive play between the valve stem and valve guide, the valve guide must be reamed out and a repair valve with oversized stem diameter* installed.

Assemble Special Tool 00 4 200 depending on the stem diameter.
Press mushroom guide (1) against the valve seat and ream out the valve guide dry from the combustion chamber end.
Turn down the reamer once.

Note
The valve seat must be machined after reaming the valve guide.

* Refer to Specifications



• Machining Valve Seat

Machine the valve seat to instructions of the tool supplier using Special Tool 00 3 520 or 00 3 580.
Dimensions and angles:

Correction cutter from Neway

After Machining Valve Seat Surface
Machine valve seat outside and inside diameters to specified size using a correction cutter* in such a manner that the specified valve seat width* is produced.

- 1 Valve seat angle
- 2 Outside dia. correction angle
- 3 Inside dia. correction angle
- 4 Valve seat outside diameter
- 5 Seat width

Valve seat dimensions*

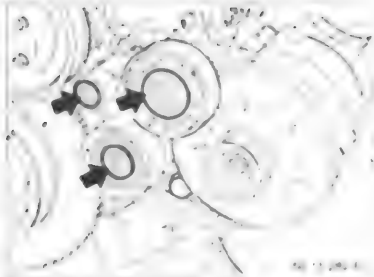
* Refer to Specifications

11-50/61

DISASSEMBLING AND ASSEMBLING CRANKCASE

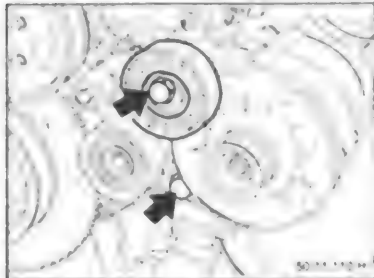
o Removing Alternator

Lift off dust caps



50 11 112 H

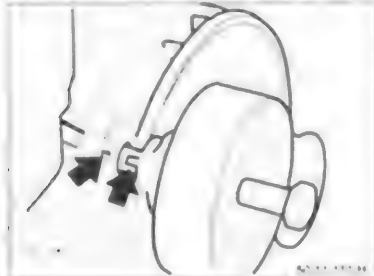
Unscrew bolts and remove alternator



50 11 113 H

Installation

Check retaining tab on bearing of the reversing roller



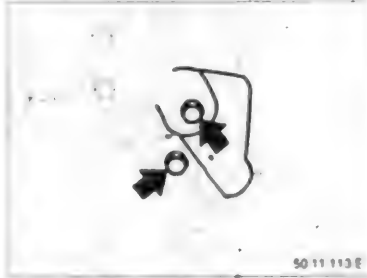
50 11 114 H



50 11 112 H

o Removing Tensioning Roller and Console

Unscrew tensioning roller.



50 11 113 E

Unscrew console



50 11 114 H

Note

The hydraulic belt tensioner is filled with oil, so that a removed element must only be stored standing upright. Incorrectly stored elements can normally be bled by compressing several times.

Installation

Check installed direction.

11-50/62

• Removing Oil Filter Housing

Unscrew screws and remove oil filter housing.

Installation
Check for dowel sleeves.

Installation
Check gasket, replacing it if necessary.

• Removing Water Pump

Hold pulley tight on the drive belt and unscrew bolts.

Installation
Tightening torque*

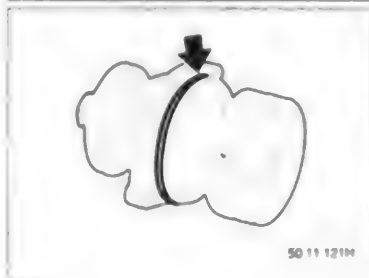
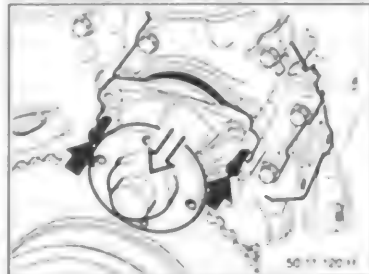
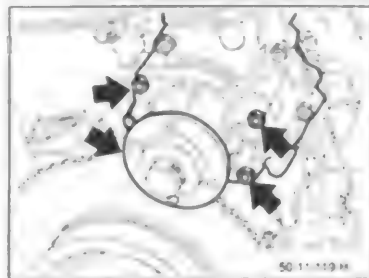
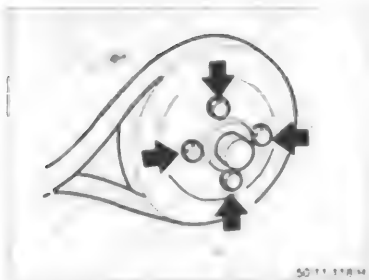
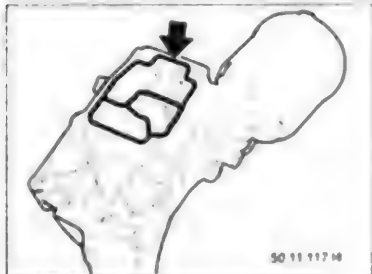
Unscrew bolts.

Installation
Tightening torque**.

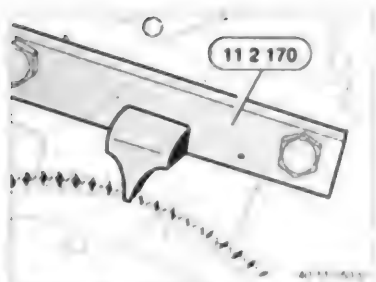
Screw two M6 bolts into tapped bores (1) and press water pump out of the end cover uniformly.

Installation
Check O-ring, replacing it if necessary, and coat it with lubricant**.
Tightening torque.

* Refer to Specifications
** Source of Supply: BMW Parts



11-50/63



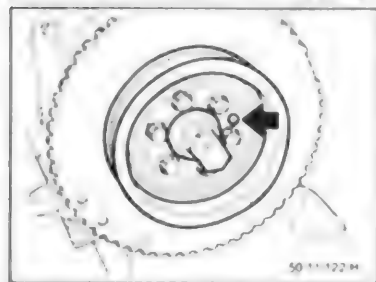
11 2 170

o Removing Vibration Damper

Block engine using Special Tool 11 2 170.

Important!

Do not block the engine with a mandrel.



50 11 122 H

Unscrew bolts on vibration damper and remove vibration damper.

Installation

Align dowel pin bore in vibration damper with the dowel pin.
Tightening torque*.



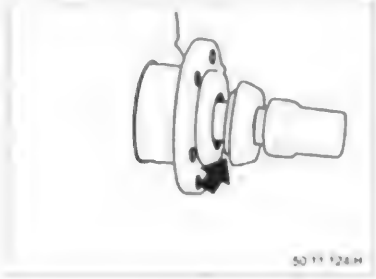
50 11 123 H

o Removing Vibration Damper Hub

Hold flywheel using Special Tool 11 2 170.

Unscrew central bolt.

Remove washer and hub.

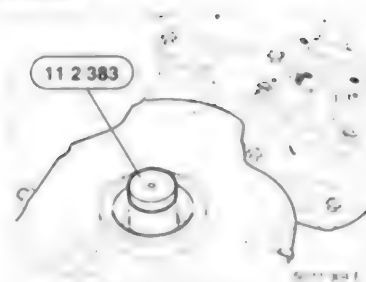


50 11 124 H

Installation

Align groove of hub with the woodruff key.
Shoulder of washer faces the hub.
Central bolt tightening torque*.

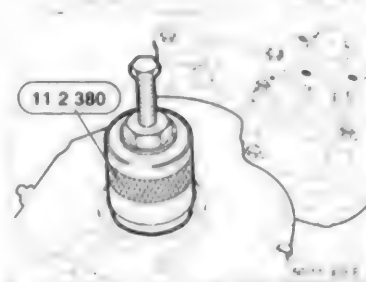
* Refer to Specifications



11 2 383

o Replacing Front Radial Oil Seal

Apply Special Tool 11 2 383 on crankshaft.

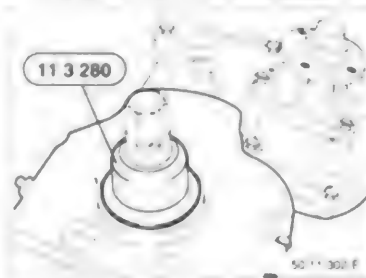


11 2 380

Remove radial oil seal.

Screw in Special Tool 11 2 380 far enough that it is firmly connected with the radial oil seal.

Then pull out radial oil seal by screwing in the bolt.



11 3 280

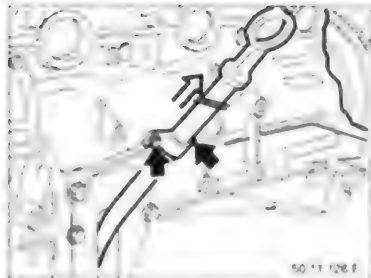
Installation

Lubricate sealing lips of new radial oil seal with oil.
Install radial oil seal flush with the timing case cover using Special Tool 11 3 280 and the central bolt.

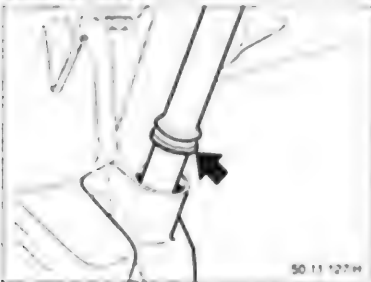
11-50/64

o Removing Oil Pan

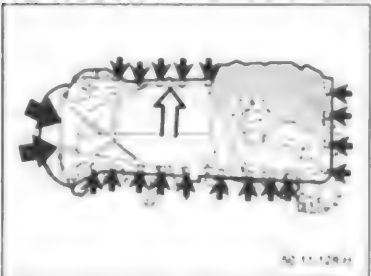
Unscrew and pull out oil dipstick guide tube.



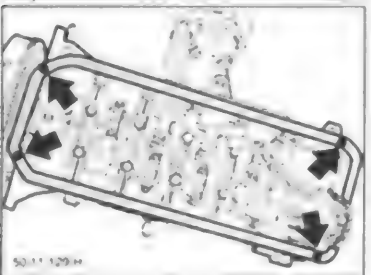
50 11 126 E



50 11 127 H



50 11 128 H



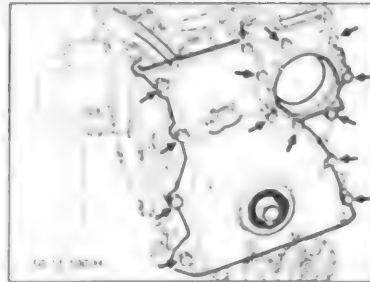
50 11 129 H

Installation
Check seal, replacing it if necessary.

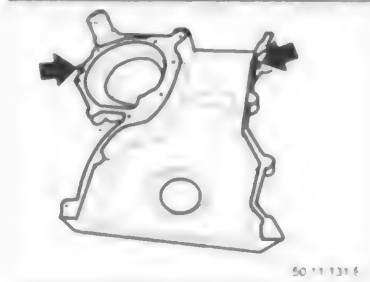
Unscrew all bolts and remove oil pan.

Installation
Check gasket, replacing it if necessary.
Apply 3 Bond 1209** permanently elastic sealing compound at joints of timing case at front end and rear cover at rear end.

** Source of Supply: BMW Parts



50 11 130 H



50 11 131 E

o Removing Lower Timing Case Cover

Unscrew bolts.
Lift off timing case cover.

Note
The timing case cover can also be taken off without removal of the water pump.

Installation
Replace gaskets.
Check for dowel pins.

11-50/65

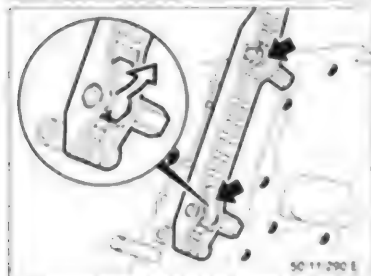


o Removing Lower Timing Chain and Guides

Fold tensioning rail downwards.
Lift out timing chain.

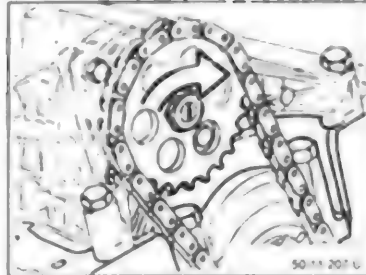


Remove tensioning rail.



Removing Chain Guide:

Lift upper and lower retainers.
Pull off chain guide.

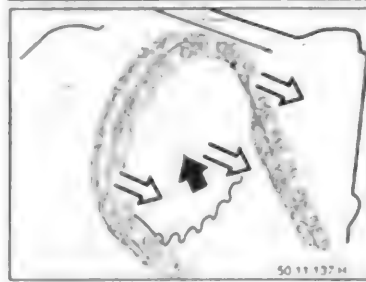


o Removing Oil Pump (E 34)

Unscrew sprocket nut.

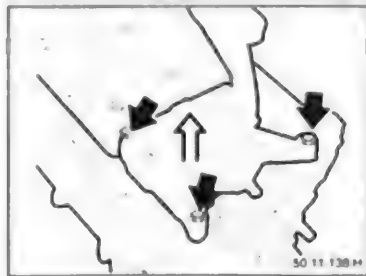
Important!
Left-hand threads.

Installation:
Tightening torque*.

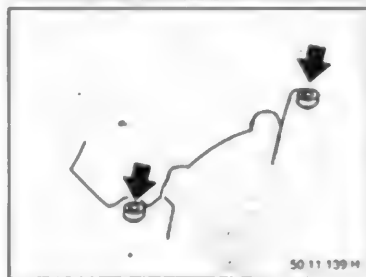


Lift off sprocket together with chain.

Installation:
Check for correct meshing of splines.



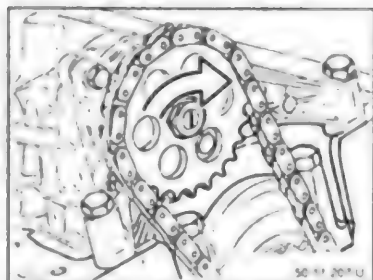
Unscrew oil pump.



Installation:
Check for dowel sleeves.

* Refer to Specifications

11-50/66

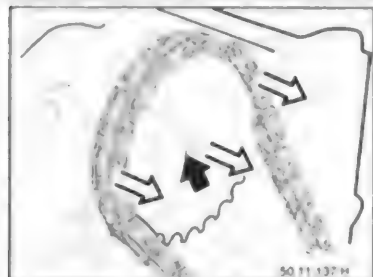


o Removing Oil Pump (E 36)

Unscrew sprocket nut

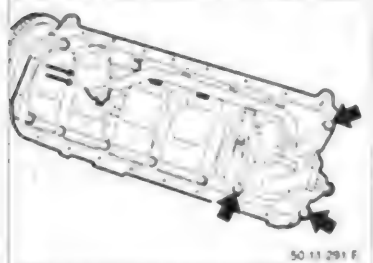
Important!
Left-hand threads.

Installation:
Tightening torque*.

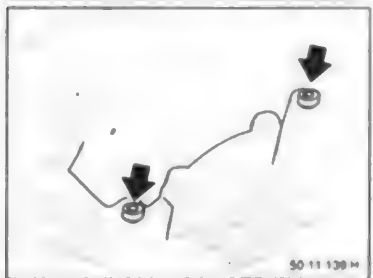


Lift off sprocket together with chain.

Installation:
Check for correct meshing of spines.

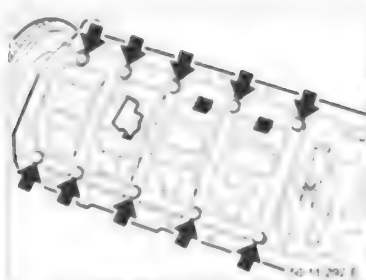


Unscrew oil pump.
Unscrew intake pipe support.

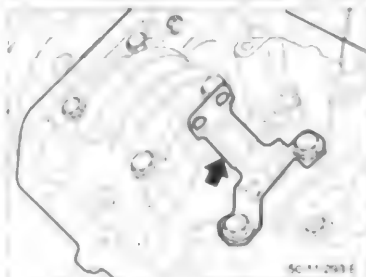


Installation:
Check for dowel sleeves

* Refer to Specifications

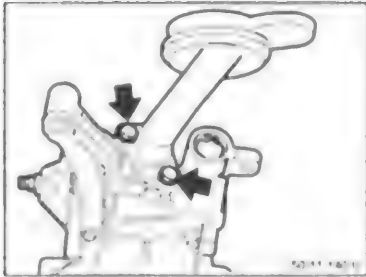


Unscrew oil baffle plate.



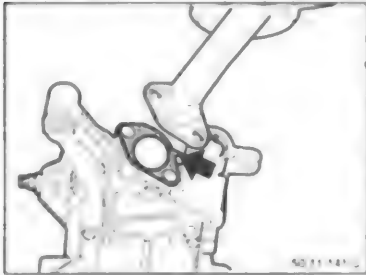
Check for intake pipe support on main bearing no. 5.

11-50/67

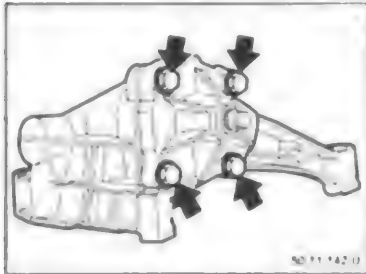


• Disassembling Oil Pump

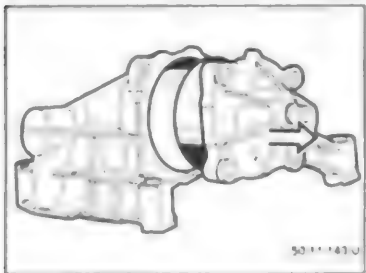
Unscrew intake pipe.



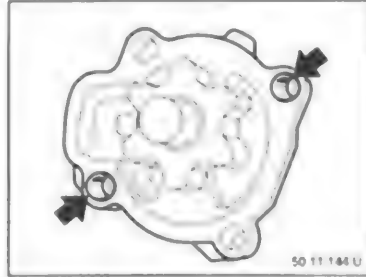
Installation
Tab on gasket points to the intake basket.



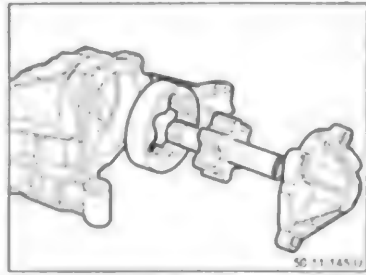
Screw on pump body.



Remove pump front section together with shaft and rotor.

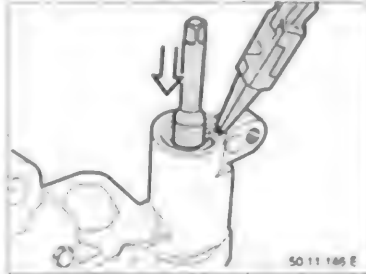


Installation
Check for dowel sleeves.



Installation
Inspect all parts for wear.

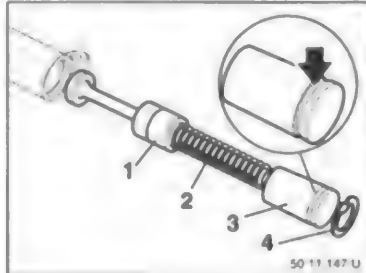
Scoring in body
Wear on rotors
Wear and scoring on bearing surfaces



Removing Pressure Relief Valve:

Press down lightly on sleeve using a suitable punch.
Lift out circlip and remove valve.

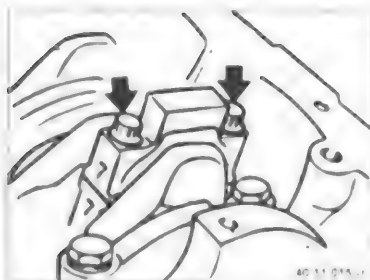
Caution!
Strong spring force.



Installation
1 Plunger
2 Spring
3 Sleeve and O-ring
4 Circlip

Important!
Check seal, replacing it if necessary.
Don't damage the sleeve.

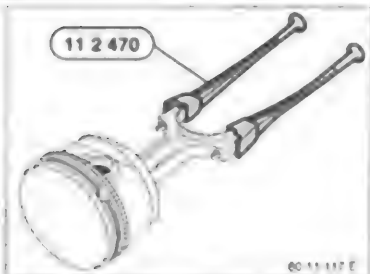
11-50/68



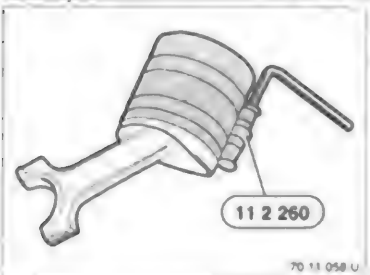
60 11 015 U



50 11 500 U



60 11 117 E



70 11 058 U

e Removing Connecting Rod and Piston

Unscrew conrod bearing cap.
Pull out connecting rod and piston to the cylinder head end.

Important!

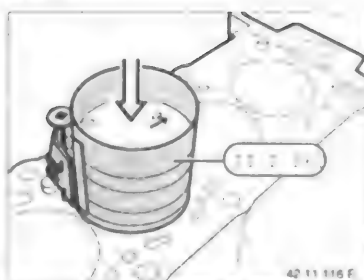
Reinstall piston, connecting rod and bearing shells in the same installed position. Connecting rods and bearing caps are marked with the same pair number and must not be mixed up.

Installation

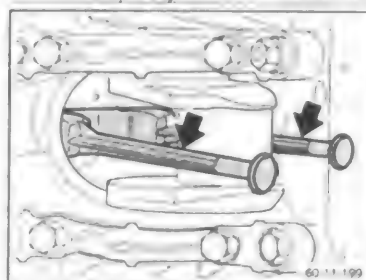
Apply Special Tool 11 2 470 in connecting rod.

Installation

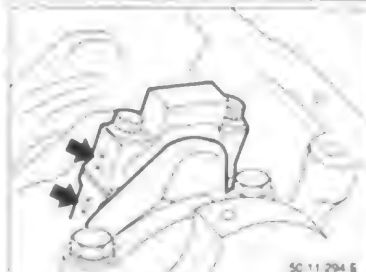
Lubricate piston and piston rings lightly with oil.
Align gaps of piston rings (offset approx. 120°, but not above the piston pin eye).
Compress piston rings using Special Tool 11 2 260.



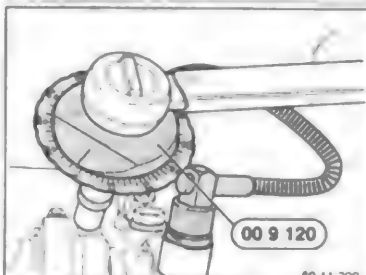
42 11 116 E



60 11 199



50 11 294 E



60 11 200

Installation

Insert piston that arrow points to camshaft drive.
Compressing tool must bear flat on crankcase all around.
Press in piston only with finger force (do not knock in!).

Installation

Guide crankshaft journal and connecting rod together.

Installation

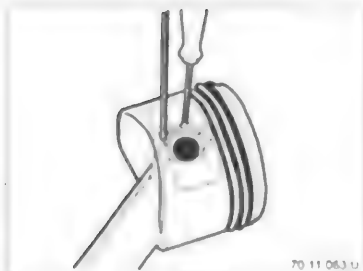
Lubricate conrod bearing shells with oil.
Mount bearing cap that pair numbers are aligned.
Screw in new conrod bolts.

Installation

Tighten conrod bearing cap bolts using Special Tool 00 9 120 or 11 2 110.
Conrod bolt tightening torque*.

* Refer to Specifications

11-50/69



g Removing Connecting Rod

Remove circlip and press out piston pin.

Important!

Pistons and piston pins are matched and must not be mixed up.

Installation

Insert circlip in such a manner that its gap is opposite the opening.



Installation

Install connecting rod in such a manner that when the pair number is visible the installed direction arrow on the piston points to the right.



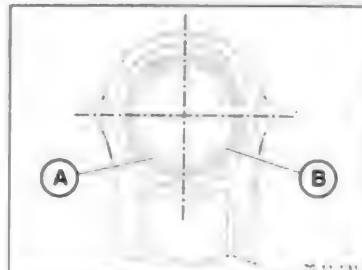
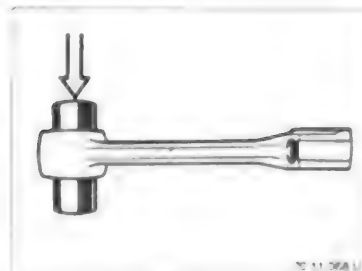
Checking Connecting Rod

Check connecting rod for deviation in parallelism and distortion.

A Testing distance*

B Permissible parallel deviation at distance A*

C Max. permissible distortion to each side*

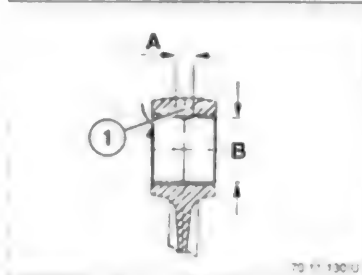


Checking Piston Pin Bush:

It should be possible to push the piston pin through the bush by hand with slight force and there must not be noticeable play.

Replacing Piston Pin Bush

Press out old bush using a suitable punch (23.5 mm dia.)
Press in new bush with bush gap located optionally at A or B.

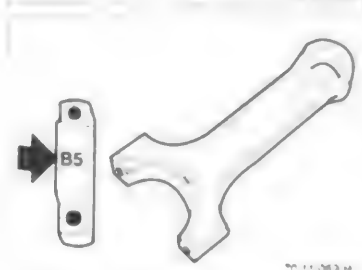


Drill oil bore (1).

A = 6 mm

B = Bore diameter*

Remove burrs from both ends of bore.
Ream out bush dry to specified diameter* using a reamer.



Replace connecting rod.

Note

Only connecting rods of the same weight class (stamped on bearing cap) may be installed in one engine.

Only connecting rods of weight class B5 are available from Parts for replacements. They cover the entire range of weight tolerances.

* Refer to Specifications

* Refer to Specifications

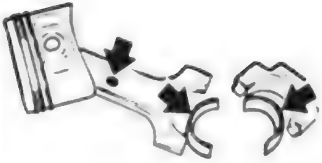
11-50/70

e Replacing Conrod Bearing Shells

Select new bearing shells to conform with paint mark on connecting rod

Important!

Check ground size of the crankshaft - also refer to "Replacing Crankshaft".



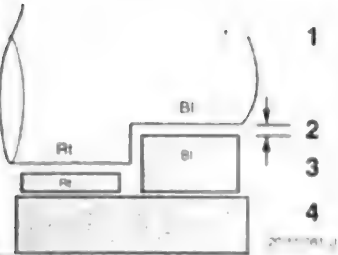
40 11 031 U

Color Code Shaft Diameter Bearing Shell Thickness* Survey

Double Classification Color Codes

Rt = Red
Bl = Blue

- 1 = Crankpin
- 2 = Bearing play
- 3 = Bearing shell thickness
- 4 = Conrod eye



20 11 031 U

Installation

Checking conrod bearing play
Only carry out for control purposes

With piston in BDC place Type PG1 Plastigage (Special Tool 00 2 590) on crankshaft wiped clean of oil.

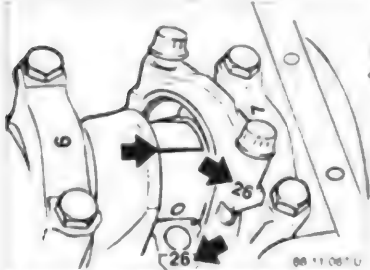
Mount bearing cap and secure with old conrod bolts tightened to specifications

Important!

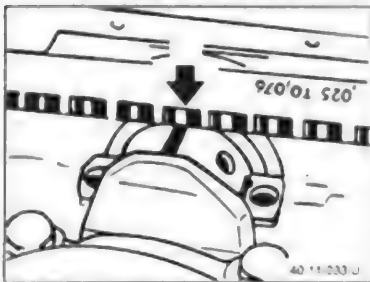
Don't turn the connecting rod or crankshaft.

Remove bearing cap and read bearing play* by measuring width of the flattened Plastigage with help of the supplied scale. Correct the bearing play by installing new bearing shells or bearing shells with a different paint mark.

* Refer to Specifications



00 11 031 U

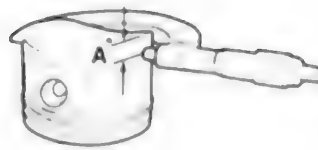


40 11 033 U

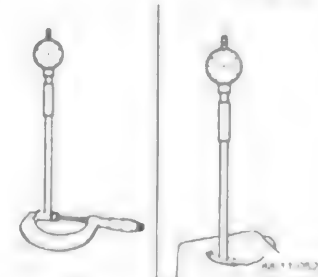
o Replacing Piston

Installation

Measure the piston installed clearance before installing.
Measure the piston diameter at distance* from the bottom edge of the piston and 90° to the piston pin axis using a micrometer.



40 11 032 U



Set internal caliper to zero on micrometer with the measured piston diameter. Measure cylinder bore at bottom, middle and top diagonally.

New piston installed clearance*.
Max. permissible total wear clearance*.

* Refer to Specifications

11-50/71

• Replacing / Checking Piston Rings

Remove piston rings using a piston ring compressing pliers

Note

Identification might not be visible on used piston rings.
Lay piston rings aside in correct sequence and position of installation.
New pistons may only be installed together with new piston rings.

Installation

Insert piston rings with "TOP" facing piston crown.

Note

2.0 Liter Version

- 1 Plain compression ring
- 2 Stepped taper face ring "Top" (check installed position)
- 3 Slotted oil scraper ring with rubber lined spring

Installation

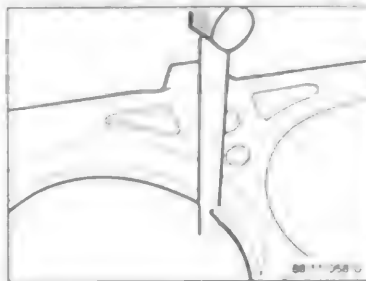
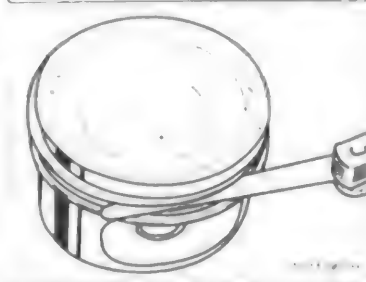
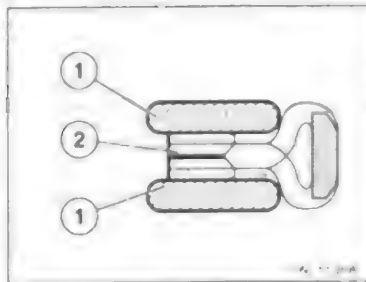
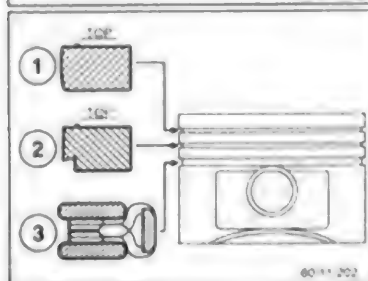
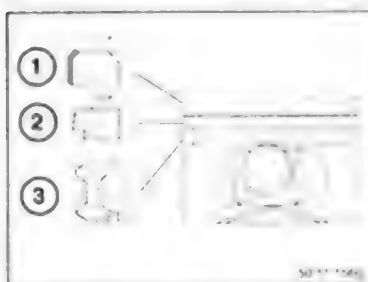
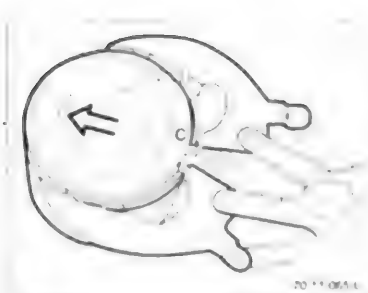
Insert piston rings with "TOP" facing piston crown.

Note

2.5 Liter Version

- 1 Plain compression ring
- 2 Stepped taper face ring "Top" (check installed position)
- 3 Three-piece steel band ring

Offset piston ring gaps about 120° to each other, but not above the piston pin eye.



Installation

The oil scraper ring consists of two steel band rings (1) and one spring ring (2).
Install all parts separately.
Offset gaps about 120°.

Measure side clearance

Specification*

Max. permissible total wear*

Measure end clearance

Specification*

Max. permissible total wear*

* Refer to Specifications

11-50/72

o Removing Clutch - Flywheel

Hold flywheel using Special Tool 11 2 170

Unscrew bolts uniformly.
Remove pressure plate and drive plate

Installation
Check for dowel pins

Installation

- 1 Flywheel
- 2 Drive plate
- 3 Pressure plate

Note

Flat side of drive plate (2) faces towards the transmission.

Installation

Center drive plate using Special Tool 21 2 130 and tighten bolts in several steps. Tightening torque*.

Unscrew bolts and remove flywheel.

Installation

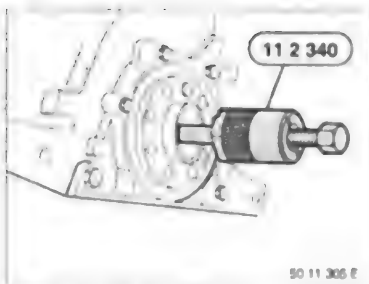
Clean threads of tapped bores and install new micro-encapsulated bolts. Tightening torque*.

Installation

Check for dowel sleeve.

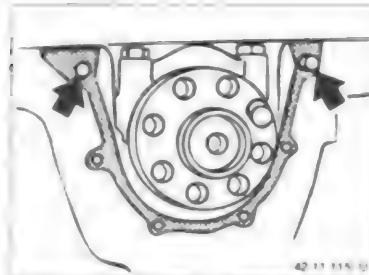
* Refer to Specifications

11-50/73

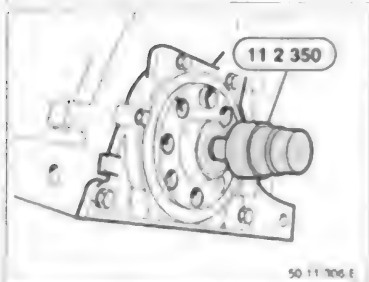


o Replacing Pilot Bearing in Crankshaft

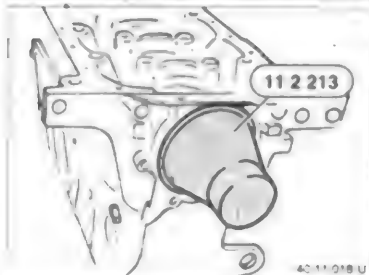
Remove pilot bearing using Special Tool 11 2 340



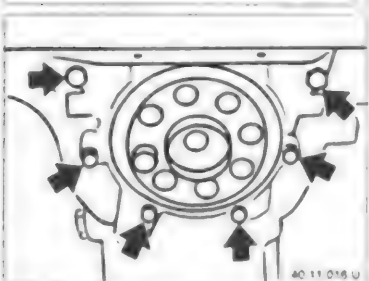
Installation:
Check for correct fit of dowel sleeves.
Replace gasket.



Installation:
Insert and drive in new pilot bearing as far as stop using Special Tools 11 2 350 and 00 5 500

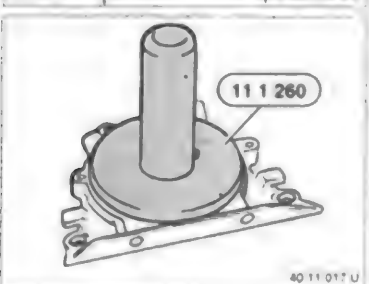


Installation:
Apply Special Tool 11 2 213 on crankshaft.
Lubricate sealing lip of radial oil seal with oil.
Install cover and tighten bolts.



o Removing Rear End Cover

Unscrew bolts and remove cover



Installation:
Lift out radial oil seal and drive in new seal using Special Tools 11 1 260 and 00 5 500.

11-50/74

• Removing Crankshaft

Apply Special Tool 11 2 383 on crankshaft.
Pull off sprocket using Special Tools 11 2 000 and 11 2 004 or a standard puller.

Installation

Check woodruff key for correct fit.
Heat sprocket to max. 150° C with a hot air blower or on a hotplate.

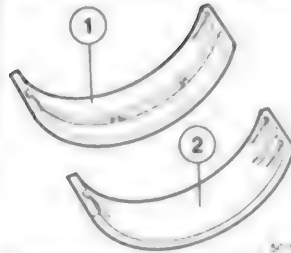
Important!

Do not exceed the specified temperature because of the rubber!

Unscrew main bearing cap bolts.
Remove main bearing caps (1 ... 7).
Lift out crankshaft.

Note

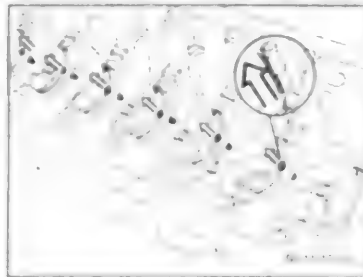
Bearing caps 1 ... 5 are marked on the exhaust side.
Bearing caps 6 and 7 are not marked.
Bearing cap 6 is the thrust bearing.



Installation

Install bearing shells (1) with a lubricating groove and one retaining tab in crankcase.

Install bearing shells (2) without a continuous lubricating groove and with two retaining tabs in the bearing caps.



Installation

Ensure that oil spray jets are used at bearings 2 ... 7.

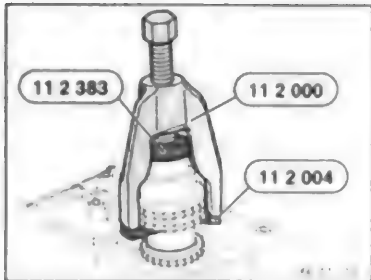
Installation

Lubricate bearing shells with oil.
Install crankshaft.

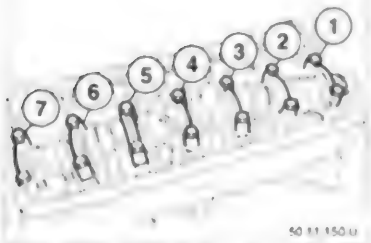
Mount bearing caps 1 ... 7 (bearing no. 1 is at the camshaft drive end) in such a manner that grooves of the bearing shell guide are all on same side.
Align bearing caps precisely.

Note

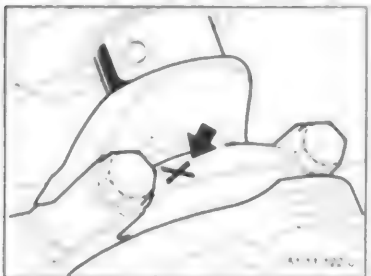
Thrust bearing shells are installed at bearing no. 6.



50 11 500 0



50 11 150 0



50 11 150 0

11-50/75

Installation

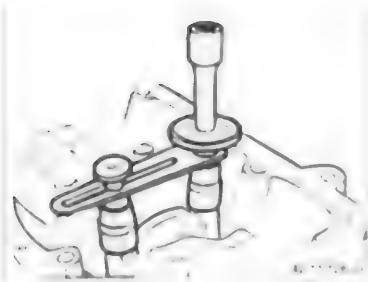
Main bearing cap bolts must always be replaced with new bolts.
Keep oil out of tapped bores (danger of cracking the block).
Wash and lubricate bolts with oil.



Replacing Piston Cooling Spray Jets

Note

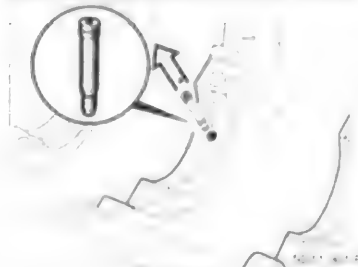
Spray jets are installed in bores of bearings 2 ... 7 and serve lubrication of piston pins and cooling of pistons.



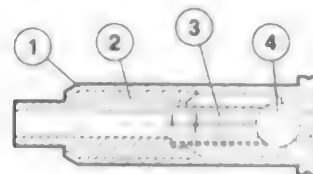
Main Bearing Cap Bolt Tightening Procedures.

- 1st Step** Tighten bolts to tightening torque in Nm*.
2nd Step Tighten bolts to torque angle* using Special Tool 11 2 110 or 00 9 120

Tightening torque*.



Pull spray jet out of crankcase.



Spray Jet Assembly:

- 1 Jet body
- 2 Jet
- 3 Spring
- 4 Ball

50 11 300 f

• Refer to Specifications

11-50/76

• Replacing Main Bearing Shells

Crankshafts are marked with yellow, green or white paint depending on main bearing tolerances

Note:
Thrust bearing shells are installed at bearing no. 6.

- Note:**
- 1 Bearing shells with continuous lubricating groove and one retaining tab (for crankcase)
 - 2 Bearing shells without continuous lubricating groove and with two retaining tabs (for bearing caps)

Installation

When replacing bearing shells (also for exchange crankshafts), classification does not apply for the allocation of bearing shells in the crankcase.
Only install yellow bearing shells in the crankcase

Check ground size of crankshaft!

Installation

Bearing shell classification for bearing caps is marked on the crankshaft with yellow, green or white paint

Important!

Check ground size* of crankshaft

1 paint stripe	Size 1 (0.25 mm)
2 paint stripes	Size 2 (0.50 mm)

Checking Axial Play

If permissible play* is exceeded, check crankshaft and thrust bearing shells and replace if necessary.

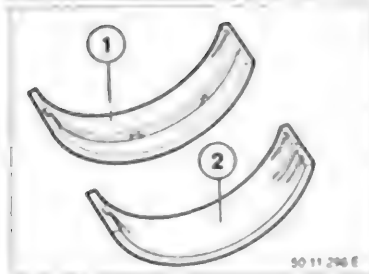
* Refer to Specifications



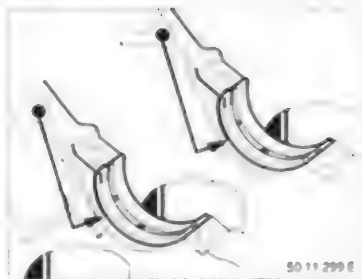
60 11 143



60 11 298 E



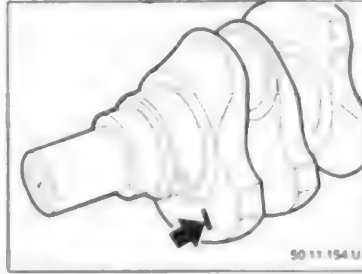
50 11 296 E



50 11 299 E



50 11 295 E

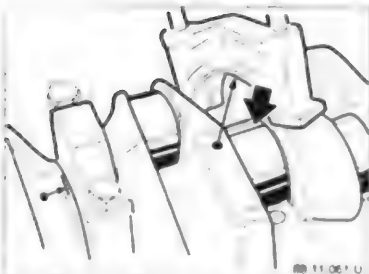


50 11 154 U



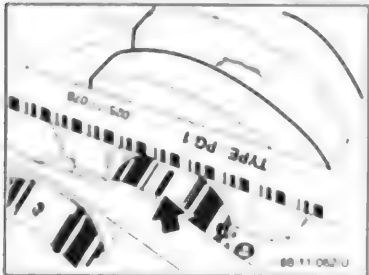
60 11 302 E

11-50/77

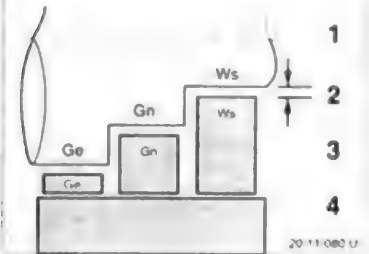


Check bearing clearance
Only carry out this step for control purposes

Install crankshaft.
Place Type PG 1 Plastigage (Special Tool 00 2 590) on crankshaft wiped clean of oil and tighten bearing cap bolts as specified. Tightening torque*.
Don't turn the crankshaft



Remove bearing cap and read bearing play* by measuring width of the flattened Plastigage with help of the supplied scale. Correct the bearing play by installing new bearing shells or bearing shells with a different paint mark



Color Code Shaft Diameter Bearing Shell Thickness* Survey

Triple Classification Color Codes

Ge = Yellow

Gn = Green

Ws = White

1 = Crankshaft diameter

2 = Bearing play

3 = Bearing shell thickness

4 = Journal diameter

* Refer to Specifications

11 Engine M51

11 00 . . .	Engine – disassemble and assemble (engine removed)	11- 51/1
	Engine – mount on assembly stand	11- 51/1
A.	Cylinder head – remove	11- 51/3
	Intake manifold and intake necks – remove	11- 51/3
	Injection pipes – remove	11- 51/3
	Ribbed drive belt – remove	11- 51/4
	Cylinder head cover – remove	11- 51/4
	Belt tensioner – remove	11- 51/4
	Vacuum pump – remove	11- 51/5
	Valve timing – remove	11- 51/5
	Camshaft adjusting procedures	11- 51/6
	Cylinder head – unscrew	11- 51/8
	Piston protrusion – measure	11- 51/10
B.	Cylinder head – disassemble and assemble	11- 51/11
	Thermostat housing – remove	11- 51/11
	Cylinder head – mount on assembly stand	11- 51/11
	Camshaft – remove	11- 51/12
	Valves – remove	11- 51/13
	Cylinder head – inspect sealing surface	11- 51/14
	Cylinder head – check for cracks in water test (cylinder head disassembled)	11- 51/15
	Valve guide and seat – machine	11- 51/15
	Valves – check for leaks (camshaft removed)	11- 51/17
C.	Crankcase – disassemble	11- 51/18
	Oil filter housing – unscrew	11- 51/18
	Oil dipstick – remove	11- 51/18
	Power steering pump – remove	11- 51/18
	Alternator – remove	11- 51/19
	Console for alternator and power steering pump – remove	11- 51/19
	Console for AC compressor – remove	11- 51/19
	Wire harness for engine – remove	11- 51/19
	Oil pan – remove	11- 51/19
	Water pump – remove	11- 51/20
	Vibration damper – remove	11- 51/21
	Vibration damper hub – remove	11- 51/21
	Drive chain – remove	11- 51/21
	Engine console – unscrew	11- 51/23
	Injection pump drive chain adjusting procedures	11- 51/23
	Injection pump – unscrew	11- 51/24
	Oil pump – remove	11- 51/25
	Oil pump – disassemble and assemble	11- 51/25
	Injection pump console – remove	11- 51/26
	Clutch / flywheel – remove	11- 51/27
	Pilot bearing in crankshaft – replace	11- 51/27
	Rear end cover – remove	11- 51/28
	Connecting rod and piston – remove	11- 51/29
	Connecting rod – remove/inspect/repair	11- 51/30
	Connecting rod bearing shells – replace	11- 51/31
	Piston – replace/check	11- 51/32
	Piston rings – replace/check	11- 51/32
	Crankshaft – remove	11- 51/32
	Main bearing shells – replace	11- 51/33

11-51/1

11 00 DISASSEMBLING AND ASSEMBLING ENGINE (Engine Removed)

General Information for Working on Valve Timing

Attention must be paid to the following if work had been carried out on the cylinder head, for which the camshaft was removed. Hydraulic valve tappets expand when without load from the camshaft and must be allowed enough time after installation to constrict again. Consequently fast assembly could cause "closed" valves to still be open and have contact with the pistons.

The following waiting times must be allowed between installation of the camshaft and mounting of the cylinder head

Ambient Temperature:	Time
20° C	4 minutes
10 to 20° C	11 minutes
0 to 10° C	30 minutes

After installation of the camshaft and timing chain the engine may first be cranked after the following waiting times:

Ambient Temperature:	Time
20° C	10 minutes
10 to 20° C	30 minutes
0 to 10° C	75 minutes

Working on Valve Train with Mounted Cylinder Head

Turn crankshaft in engine's direction of rotation to approx. 30° from the TDC mark, so that in this manner no pistons are in TDC.

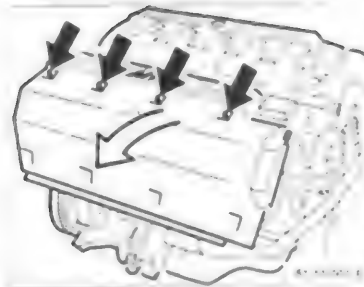
Install camshaft so that the cam peaks of cylinder no. 6 overlap.

Conform with the above mentioned waiting times. Turn crankshaft back to TDC position and mount timing chain.

Crank engine not earlier than 10 minutes after installation of the camshaft.

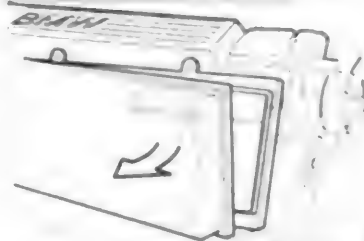
Disassembling and repairing the engine are described in chronological sequence on the following pages. The positions shown in the list of contents will help in taking up work again after an interruption or finding different points more easily. They only describe the direct removal or installation, but not the complete scope of work.

If necessary, drain engine oil and fill engine with new engine oil after completion of engine assembly. Check oil level after installation and road test.

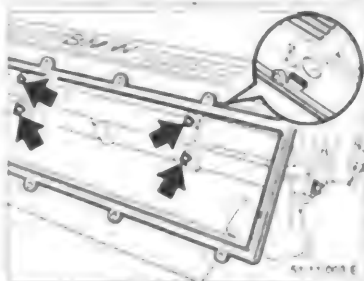


o Mounting Engine on Assembly Stand

Remove air cleaner.
Unscrew upper housing section.

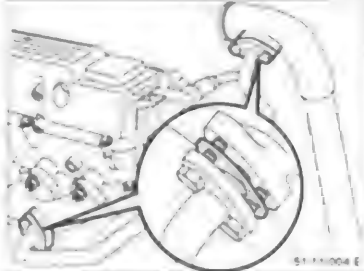


Take air filter element out.



Unscrew air cleaner housing and lift off together with the intake channel.

Installation:
Pay attention to O-ring for crankcase breather.

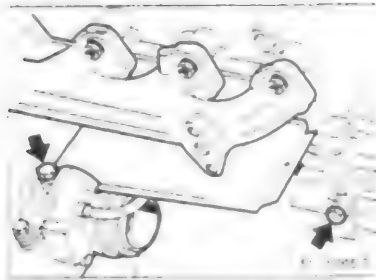


Unscrew EGR pipe.

Installation:
Tightening torque*.

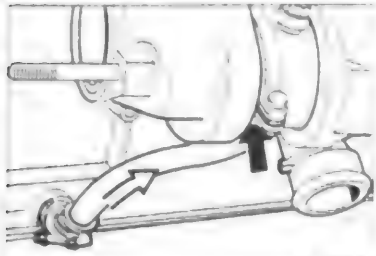
* Refer to Specifications

11-51/2



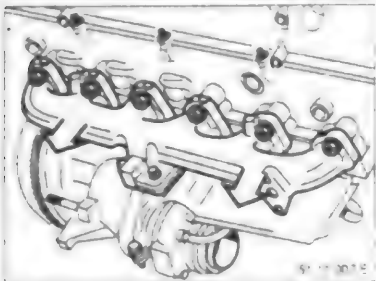
Unscrew oil supply pipe.

Installation:
Replace gaskets (2 each).
Tightening torque*.



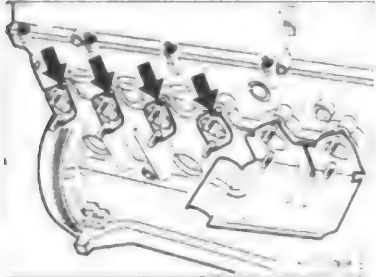
Unscrew oil return pipe.

Installation:
Replace gaskets.
Tightening torque*.



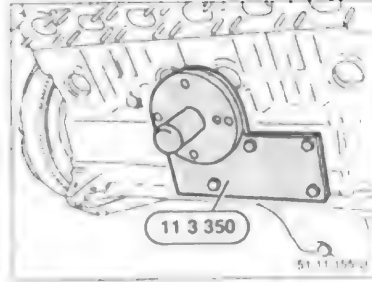
Unscrew exhaust manifold complete with turbocharger.

Important!
Pay attention to shims.



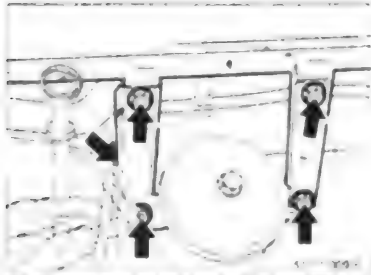
Installation:
Pay attention to arrangement of heat shields and gaskets; pins face out.
Tighten from inside to outside!
Tightening torque*.

* Refer to Specifications



Mount engine on Special Tool 00 1 490
using Special Tool 11 3 350

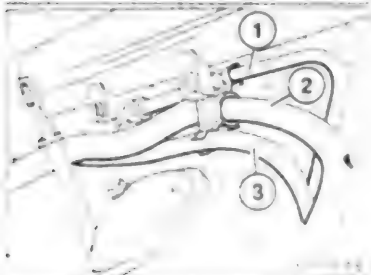
11-51/3



A REMOVING CYLINDER HEAD

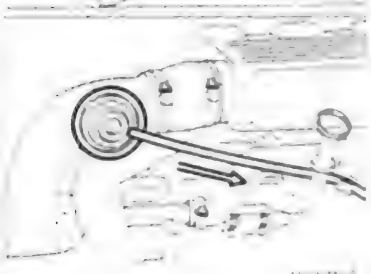
o Removing Intake Manifold with Intake Pipes:

Unscrew supports.
Unclip holders.

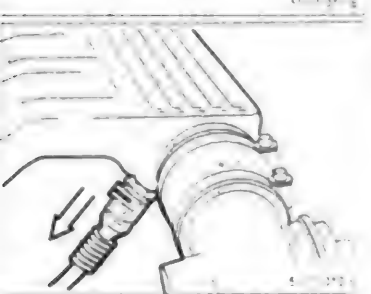


Unclip hoses from holders

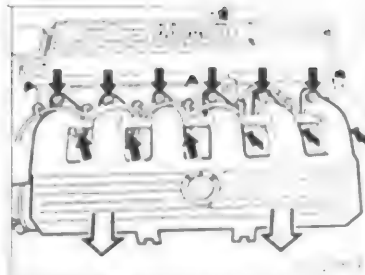
1 = Vacuum hose for brake booster
2 = Coolant hose for heater
3 = Fuel hose for injection pump



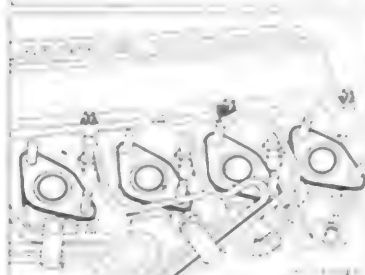
Pull vacuum hose off of EGR vacuum unit



Pull temperature sensor plug off of intake manifold.



Unscrew intake manifold



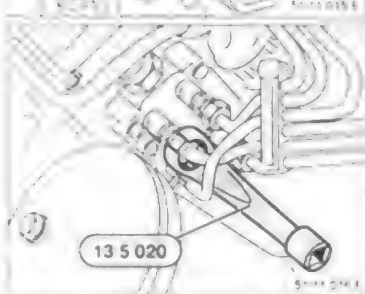
Installation:
Replace gaskets



o Removing Injection Pipes

Unscrew coupling nuts with Special Tool
13 5 020

Important!
Reposition tool in good time to avoid
bending the pipes.
Plug openings with caps



Unscrew coupling nuts on injection pipe

Installation:
Tightening torque*

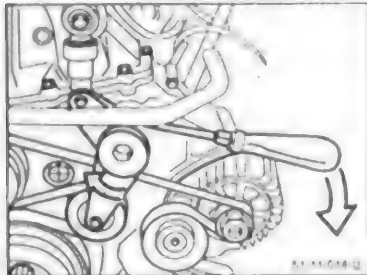
Remove complete pipes.

* - Refer to Specifications

11-51/4

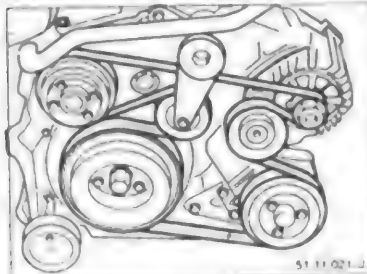


Disconnect plugs and connections for glow plugs

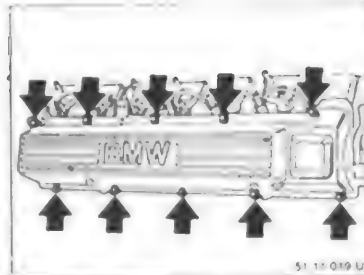


• Removing Ribbed Drive Belt

Slacken the automatic belt tensioner with a suitable lever (e.g. thick screwdriver) and remove ribbed drive belt.



Important!
Pay attention to belt arrangement.
Place multi-tooth belt in grooves correctly.



• Removing Cylinder Head Cover

Unscrew cylinder head cover

Installation

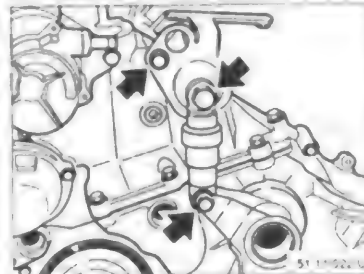
Tightening torque*

Tighten from inside to outside



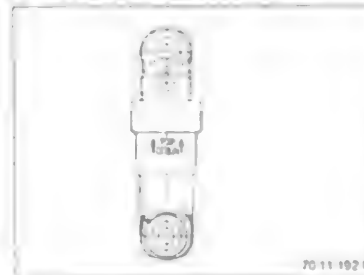
Installation

Make sure that gasket seats correctly on the pressure side of the cylinder head when mounting the cylinder head cover.



• Removing Belt Tensioner

Unscrew console for toothed belt tensioner.
Disconnect damper.



Note

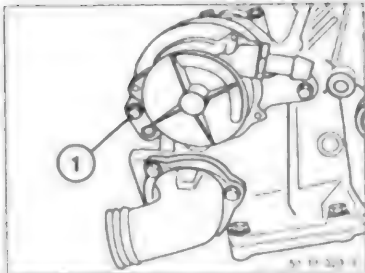
The hydraulic belt tensioner is filled with oil so that the removed element must be stored standing upright.
Incorrectly stored elements can normally be bled by compressing them several times.

* Refer to Specifications

11-51/5

o Removing Vacuum Pump

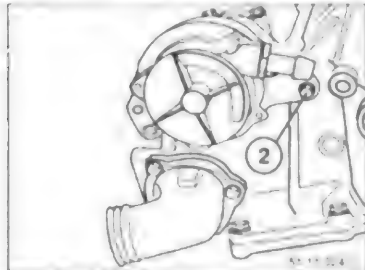
Unscrew bolt (1).



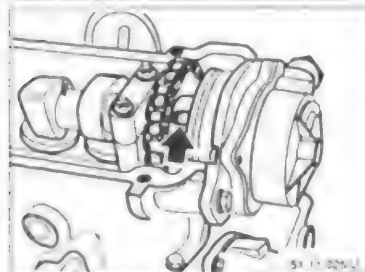
Remove bolt (2) and lift pump off

Note
Bolt is also used to hold the chain guide

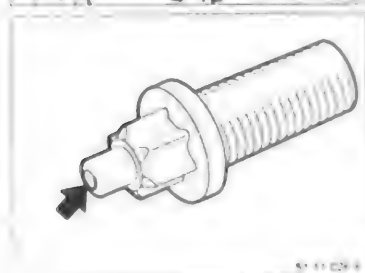
Installation
Threads are coated with a sealing cement so that a new bolt must be used or a coat of sealing cement** applied



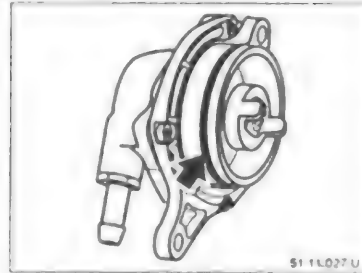
Installation
Insert drive dog into opening of camshaft sprocket.



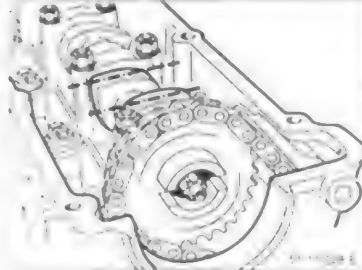
Note
Torx bolt on the camshaft sprocket is fitted with a nozzle for lubrication of the vacuum pump. Check for dirt.



** Source of Supply: BMW Parts



Installation
Replace O-ring and coat new O-ring with lubricant**

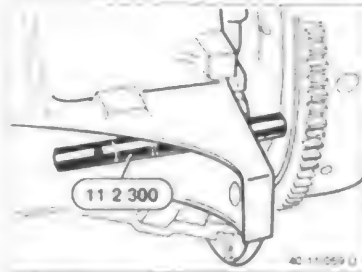


o Removing Valve Timing

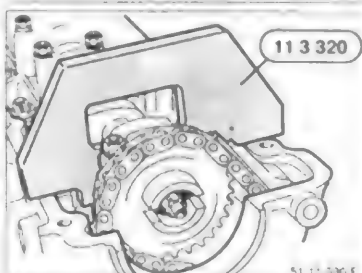
Note
Turn engine in direction of rotation until valves of cylinder no. 6 overlap (Cylinder no. 1 = power stroke.)
Cam position can also be checked through the oil filler bore when the cylinder head cover is mounted

Hold crankshaft in TDC position with Special Tool 11 2 300

Important!
Remove special tool before operating the engine again.

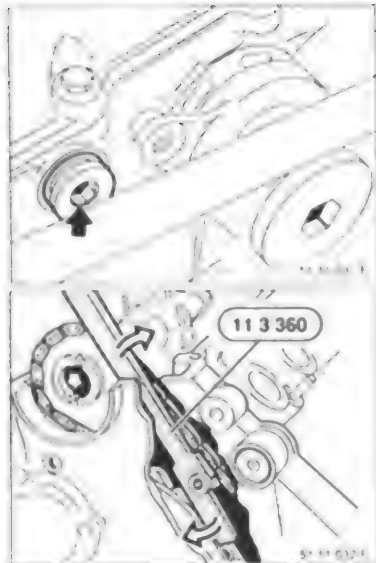


Hold camshaft with Special Tool 11 3 320



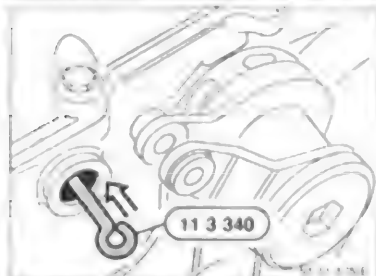
** Source of Supply: BMW Parts

11-51/6

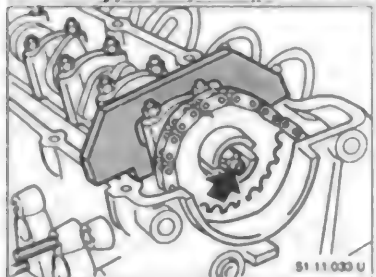


Arresting Chain Tensioner:
Unscrew plug.

Apply Special Tool 11 3 360 on chain tensioning rail and press chain tensioner in.

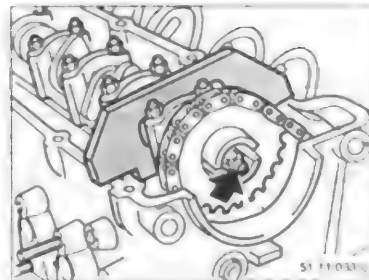


Apply Special Tool 11 3 340.



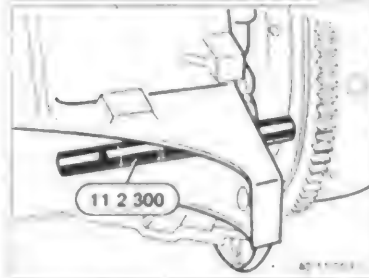
Unscrew and remove sprocket.

Installation:
Bearing surface must be clean and free of grease.



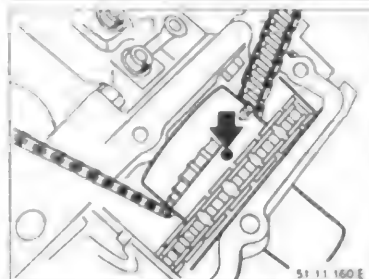
o Camshaft Adjusting Procedures

Mount sprocket with chain on camshaft loosely.



Hold crankshaft in TDC position with Special Tool 11 2 300

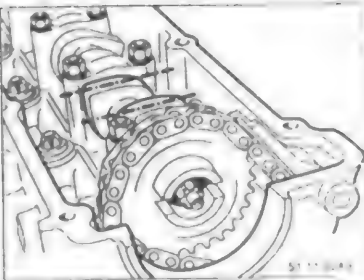
Important!
Remove special tool before operating the engine again.



Note
Mark on injection pump sprocket must face up.
If not, turn crankshaft another full turn (Crankshaft : injection pump ratio = 2 : 1.)

Important!
Mark can be seen only before installation of the cylinder head.
First remove the camshaft if the crankshaft has to be turned when the cylinder head is mounted.

11-51/7

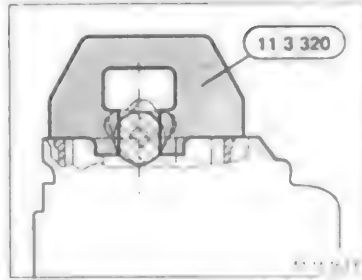


Turn camshaft until the valves of cylinder no. 6 overlap.
(Cylinder no. 1 = power stroke.)

Note:
The camshaft can be turned on the hexagon using a 27 mm wrench.

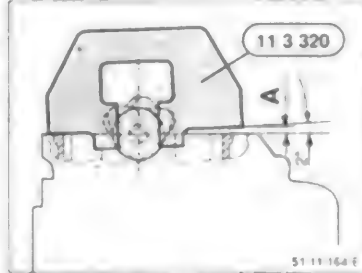


Important!
If the camshaft position has to be corrected to such an extent that valves of cylinder no. 1 and 6 are moved, first turn the crankshaft in engine's direction of rotation to about 30° away from TDC position and return to the initial position only after turning the camshaft.
This will prevent contact between valves and pistons.
Install both chain tensioners after assembling has been completed.
Crank engine in engine's direction of rotation several times.
Recheck camshaft adjustment.



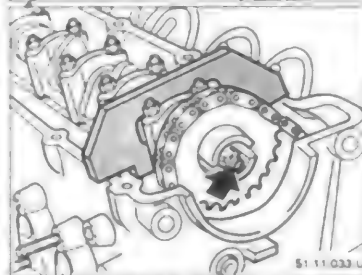
11 3 320

Note:
An empty Special Tool 11 3 320 must be used to adjust the timing of NEW or used chains up to 20,000 km of operation.



11 3 320

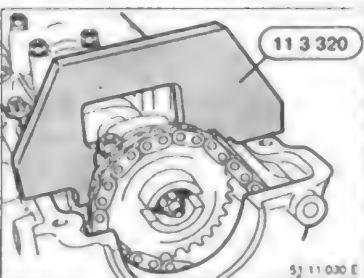
If chains with more than 20,000 km of operation are to be reused, a shim (feeler gage blade) of thickness $A = 4.61$ mm must be used on the intake side.



51 11 033 U

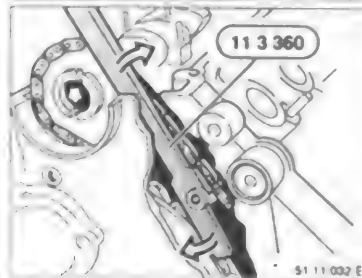
Mount sprocket with chain and tighten loosely.

Important!
Bearing surfaces must be clean and free of grease.



11 3 320

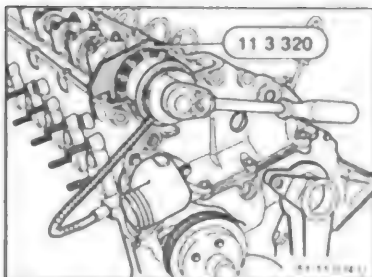
Hold camshaft with Special Tool 11 3 320



11 3 360

Apply Special Tool 11 3 360 on chain tensioning rail and press chain tensioner in. Pull Special Tool 11 3 340 out.

11-51/8

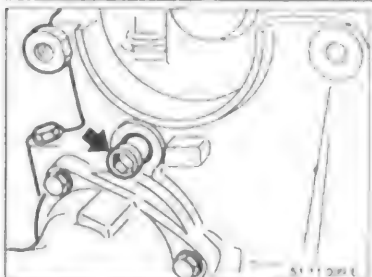


Tighten camshaft sprocket to final torque

Tightening Procedures:

Step 1 20 Nm torque

Step 2 35 ± 3° torque angle

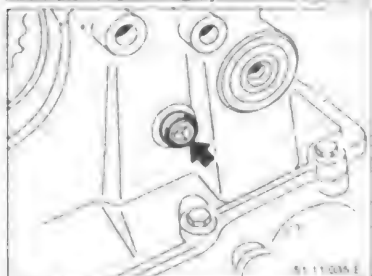


o Unscrewing Cylinder Head

Unscrew retaining pin for tensioning rail

Installation:

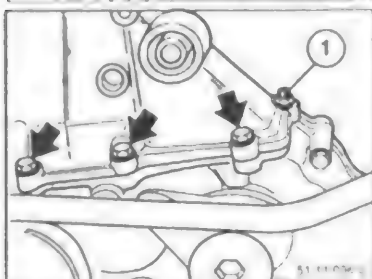
Check O-ring.



Unscrew retaining pin for chain guide.

Installation:

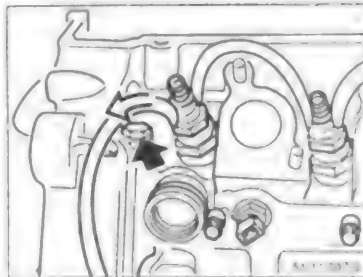
Check O-ring.



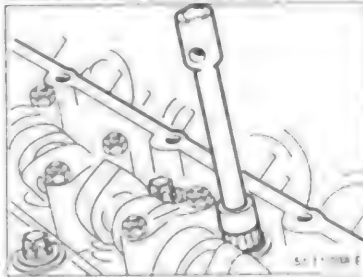
Unscrew bolts on timing case cover.

Note:

Position (1) is a stud with nut.



Unscrew bolt and pull pipe for injection valve leak off.



Unscrew cylinder head bolts from outside to inside in several steps. Lift cylinder head off.



Important!

Conform with waiting time for hydraulic valve tappets when installing the cylinder head – refer to general information. The gasket thickness must be determined after working on the crankshaft pistons (refer to "Measuring Piston Protrusion").

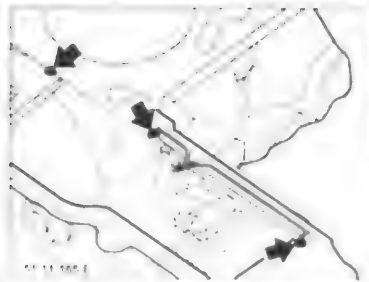
Installation:

Clean mating surfaces on cylinder head and crankcase; if necessary remove pieces of gasket with gasket remover** and a hard wood scraper. Be careful that pieces of gasket do not fall into oil and coolant bores.

Tapped bores in crankcase must be free of dirt and oil.

** Source of Supply: BMW Parts

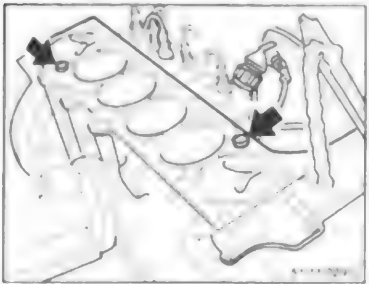
11-51/9



Installation

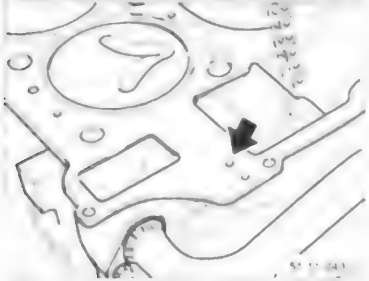
Replace sealing strip on console for the injection pump.

Apply coat of 3 Bond 1209** permanently elastic sealing compound on joint surfaces to the timing case cover.



Installation

Install new cylinder head gasket
Check dowel sleeves (1) for damage and correct installation.

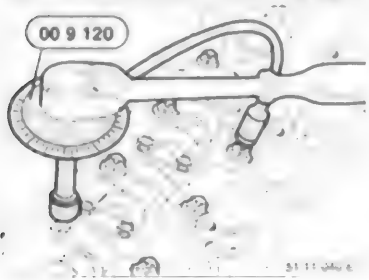


Installation

Use a gasket with same thickness mark (number of holes)

Exception

Work on crankcase which changes piston protrusion (refer to "Measuring Piston Protrusion")



Installation

Mount cylinder head and install new bolts (lubricated lightly with oil)
Keep oil out of tapped bores
Use Special Tool 11 2 110 or 00 9 120 to tighten bolts to torque angle

** Source of Supply: BMW Parts *

Installation

Bolt tightening procedures:
Tighten bolts diagonally from middle to outside in four steps.
Loosen bolts in reverse sequence.
Tightening torque*.

* Refer to Specifications

11-51/10

Unscrew coolant pipe.

Installation
Check O-ring.
Belt tensioner must have been installed first.

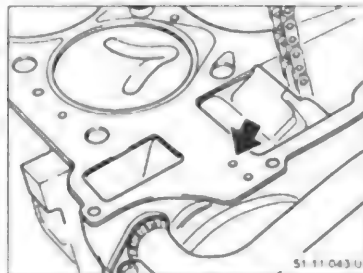


Figure out the mean value from the six determined values.

Cylinder Head Gaskets

Piston Protrusion of All Six Pistons (Mean Value in mm)	Identification of Cyl. Head Gasket (Number of Holes)
0.54 ... 0.76	2
0.76 ... 0.99	3

Note:

A gasket with three-hole identification must be used if, however, one or more cylinders have piston protrusion of more than 0.81 mm.

o Measuring Piston Protrusion

Thickness of the cylinder head gasket to be installed depends on the highest piston protrusion of all six pistons.

Procedures:

Apply dial gage with Special Tool 00 2 530 on cleaned cylinder head sealing surface and set to zero with preload.

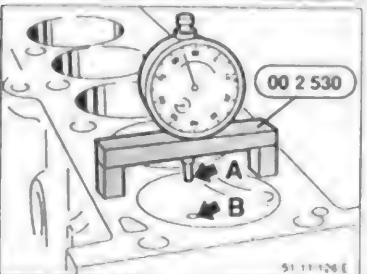
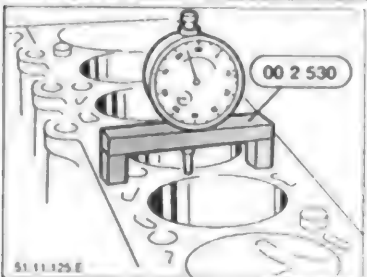
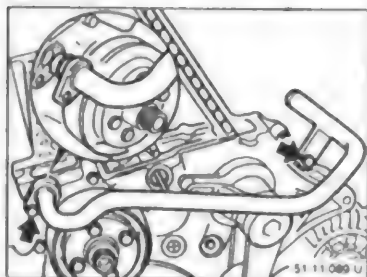
Apply dial gage at measuring point "A" on cleaned piston and find the highest point by turning the crankshaft.

Note the displayed "piston protrusion A" value.

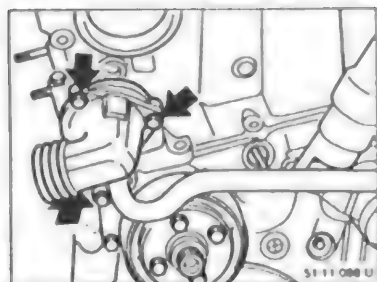
Apply dial gage at measuring point "B" and note "piston protrusion B".

The mean value of dimensions "A" + "B" results in the "piston protrusion" of a piston.

Carry out these measurements on all six pistons.



11-51/11



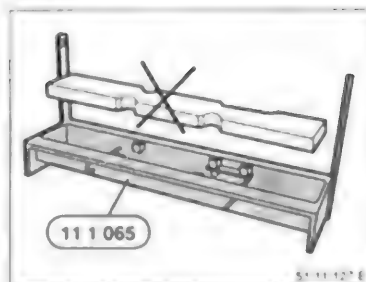
B. DISASSEMBLING AND ASSEMBLING CYLINDER HEAD

o Removing Thermostat Housing

(This operation is only necessary when disassembling the complete cylinder head.)

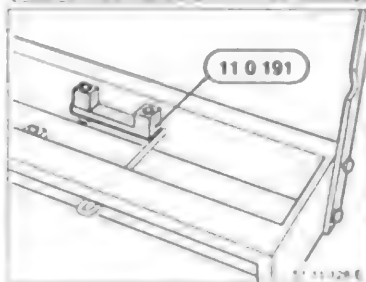
Loosen bolts and remove housing and thermostat.

Installation:
Vent bore faces up.

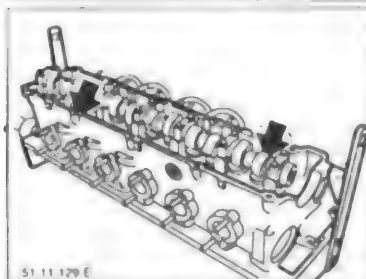


o Mounting Cylinder Head on Assembly Stand

Mount Special Tool 11 1 065 on Special Tool 00 1 490.
Do not insert Special Tool 11 3 132 (If any).



Note:
Screw Special Tool 11 0 191 on already supplied assembly stands.



Mount cylinder head on assembly stand with supplied bolts.

11-51/12



50 11 500 0

• Removing Camshaft:

Caution!

The camshaft could be damaged or broken when cylinder head would be incorrectly disassembled/assembled without use of an assembly stand.
In addition, valves could be bent through contact with piston crowns when mounting the cylinder head on the crankcase.
Always conform with assembly procedures and sequence.

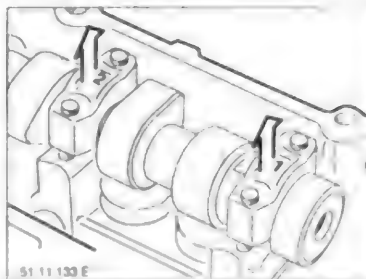
Place Special Tool 11 3 320 on cylinder head.

Secure special tool with valve cover bolts.

Preload bearing caps by turning the eccentric shaft.
Loosen all bolts for bearing caps.

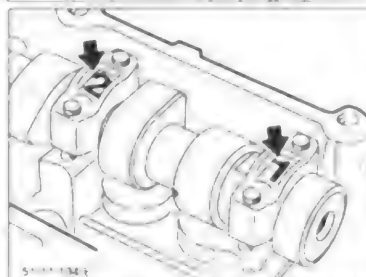
Installation:
Tightening torque*.

* Refer to Specifications



51 11 130 E

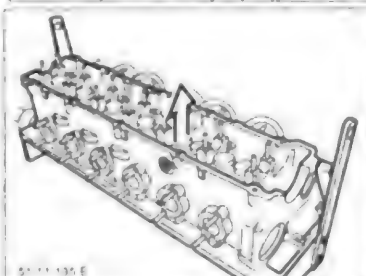
Release and remove special tool.
Lift bearing caps and camshaft out.



51 11 130 E

Installation

Bearing caps are marked with numbers from 1 to 7, which can be read from the exhaust side.



51 11 130 E

Lift hydraulic valve clearance compensators out.

Note

Pay special attention to damage of hydraulic valve clearance compensator guides.

11 3 320

51 11 130 E

51 11 130 E

51 11 130 E

11-51/13

e Removing Valves:

Installation

Hydraulic valve clearance compensators expand when without load from the camshaft and must be allowed enough time after installation to constrict again. Consequently fast assembly could cause "closed" valves to still be open and have contact with the pistons.

The following waiting times must be allowed between installation of the camshaft and mounting of the cylinder head:

Ambient Temperature:	Time:
20° C	4 minutes
10 to 20° C	11 minutes
0 to 10° C	30 minutes

After installation of the camshaft and timing chain the engine may first be cranked after the following waiting times:

Ambient Temperature:	Time:
20° C	10 minutes
10 to 20° C	30 minutes
0 to 10° C	75 minutes

If necessary, proceed as described below

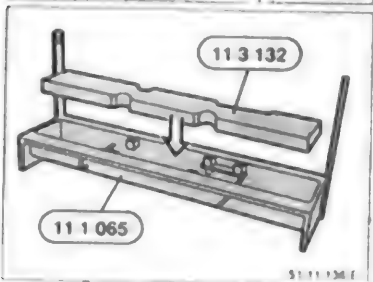
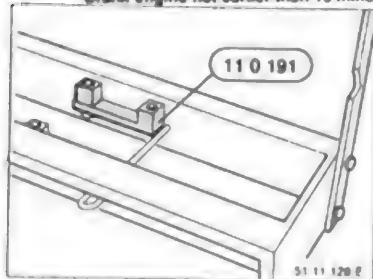
Working on Valve Train with Mounted Cylinder Head.

Turn crankshaft in engine's direction of rotation to approx. 30° from the TDC mark, so that in this manner no pistons are in TDC.

Install camshaft so that the cam peaks of cylinder no. 1 face each other.

Conform with the above mentioned waiting times. Turn crankshaft back to TDC position and mount timing chain.

Crank engine not earlier than 10 minutes after installation of the camshaft

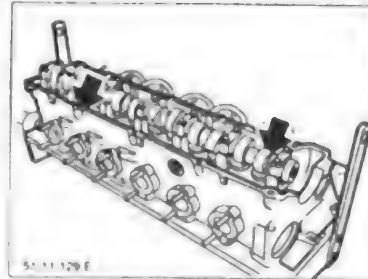


Mount Special Tool 11 1 065 on Special Tool 00 1 490

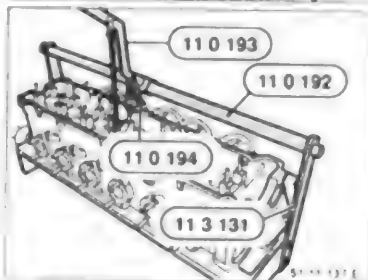
Note

Screw Special Tool 11 0 191 on already supplied assembly stands.

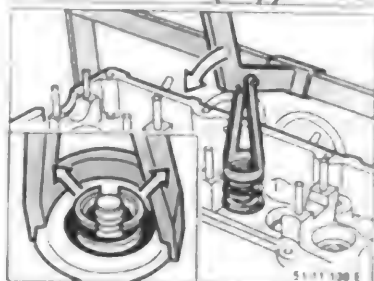
Insert Special Tool 11 3 132 (tray) into assembly stand



Mount cylinder head on assembly stand with supplied bolts.



Screw on Special Tool 11 3 131
Slide Special Tool 11 0 192 onto Special Tool 11 1 067 and mount together with Special Tools 11 0 193 and 11 0 194.

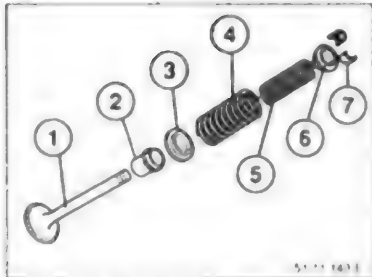


Press valve springs down and remove valve collets.
Remove valve springs and spring retainers.
Take tray out of assembly stand from underneath and pull valve out.

Installation

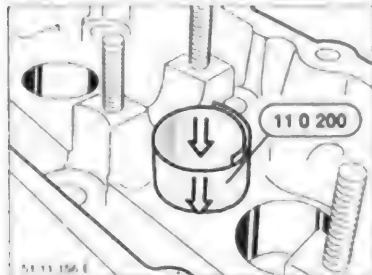
If one spring of the spring set (inner or outer spring) is damaged or broken, both springs must be replaced.
Only use inner and outer springs of the same make and with the same color code.

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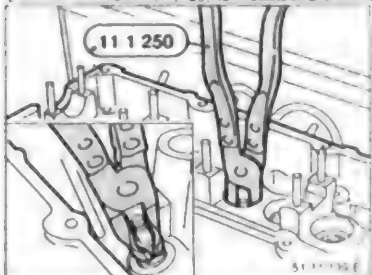
Sequence of Installation:

- 1 - Valve
- 2 - Valve stem seal
- 3 - Lower valve retainer
- 4 - Outer spring
- 5 - Inner spring
- 6 - Upper spring retainer
- 7 - Valve collets

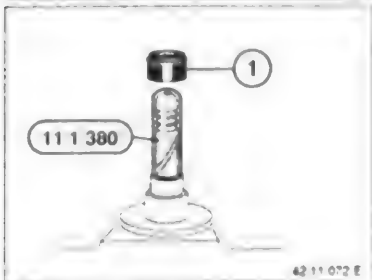


Caution!

Be careful that bearing surfaces of hydraulic valve clearance compensators are not damaged.
Use Special Tool 11 0 200

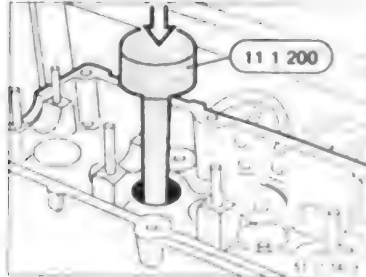


Pull valve stem seal off with Special Tool 11 1 250.



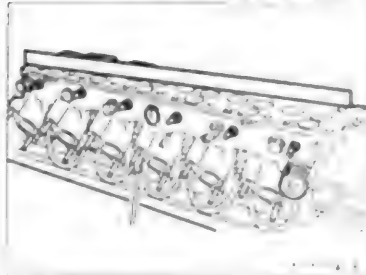
Installation

Lubricate valve stem with oil and install valve.
Apply Special Tool 11 1 380.
Lubricate new valve stem seal with oil and install.



Installation

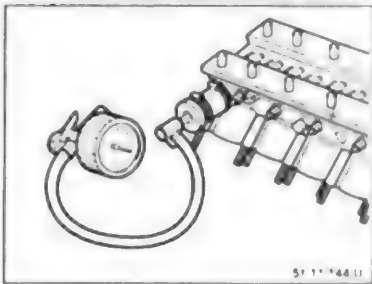
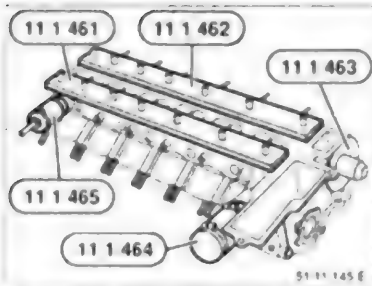
Press valve stem seal on by hand as far as stop using Special Tool 11 1 200



o Checking Cylinder Head Mating Surface

Check levelness of cylinder head mating surface with a (standard) ruler
Max deviation 0.03 mm

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o Checking Cylinder Head for Cracks in Water Test: (Cylinder Head Disassembled)

Inspect cylinder head as follows if there is suspicion of leakage in the water circuit (area of cylinder head).

Seal off water circuit with following special tools:

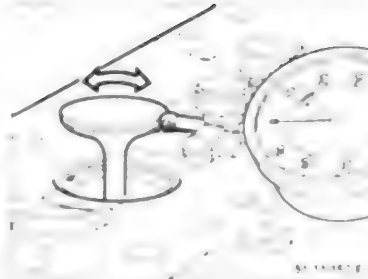
1. Sealing plates 11 1 461 / 11 1 462
2. Water pump connection plug 11 1 463
3. Plug 11 1 464
4. Plug with valve 11 1 465

Fill cylinder head with compressed air.
Test pressure = 4.5 bar.

Place cylinder head in water bath and check for leaks.

Note

Add detergent to water bath if necessary.

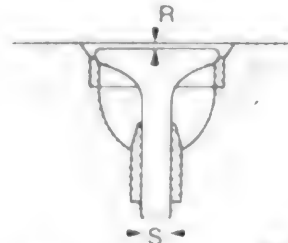


o Machining Valve Guides and Seats

To measure, insert a new valve in such a manner that the valve stem end is flush with the valve guide.

Apply dial gage and measure till play.

Max. permissible till play = 0.8 mm.



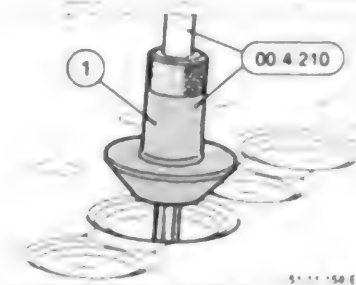
Reaming Valve Guide.

In case of excessive play between the valve stem and valve guide, the valve guide must be reamed out and a repair valve with larger stem diameter ($S = +0.1$ mm) must be installed.

Note

The valve seat must be machined after reaming out.

Check valve refusion "R".

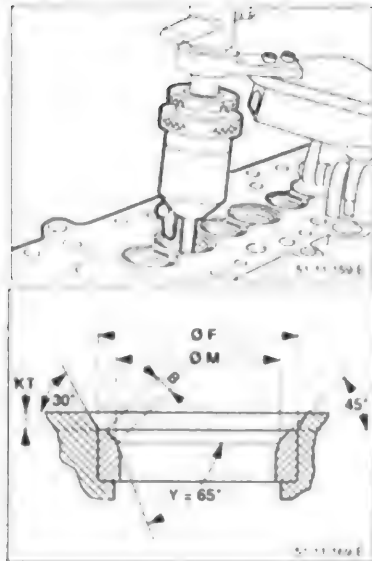


Assemble Special Tool 00 4 210 depending on the stem diameter.

Push guide pad (1) down onto valve seat and ream valve seat out dry from the combustion side.

Turn reamer down once.

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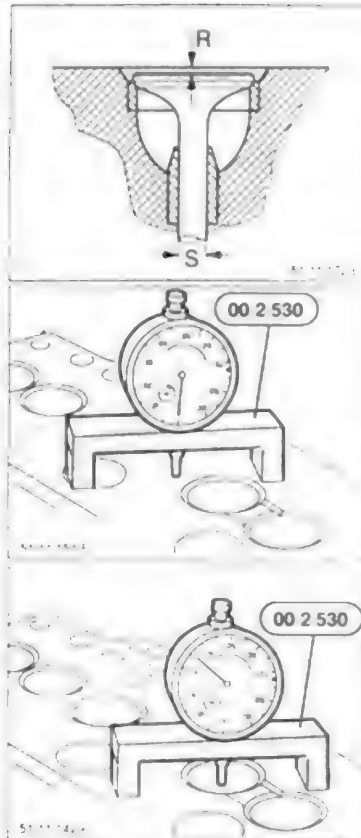
Machining Valve Seat:

Valve seat machining tool from Hunger and five-cutter cutting tool from New Way are approved for the machining of valve seat inserts.

After machining the valve seat angle, produce valve seat diameter "M" and valve seat width "B" by machining correction angle "Y" and cutting "KT" vertically.

Valve seat dimensions:

M = Valve seat diameter
B = Valve seat width
Y = Correction angle
F = Correction diameter
KT = Correction depth



Measuring Valve Retraction "R".

The valve head thickness must be selected to conform with specified valve retraction "R".

Caution!

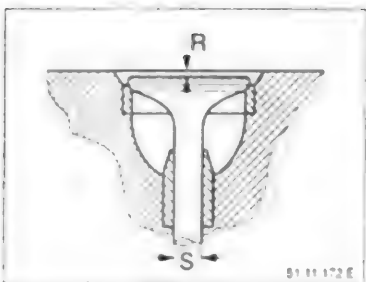
Valves with incorrect valve head thickness will cause engine damage.

Apply dial gage in Special Tool 00 2 530 on cleaned cylinder head mating surface and set to zero with preload.

Apply dial gage on valve head and measure valve retraction distance "R".

Specified distance "R":

Intake valve 0.65 ... 0.85 mm
Exhaust valve 0.85 ... 1.05 mm



A repair valve with thicker valve head must be used after machining the valve seat.

Machine valve seat inserts until specified valve retraction "R" is reached.

Important!

Valves may not be ground in.

• Refer to Specifications

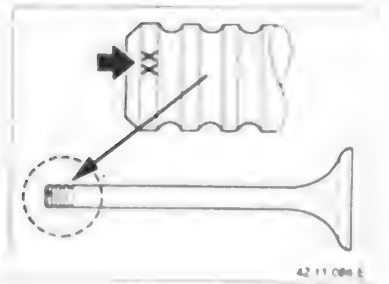
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Valves with thicker valve heads are available in addition to the standard valves to reach distance "R":

- o Checking Valve for Leaks:
(Camshaft Removed)

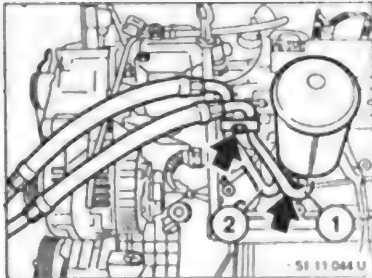
Fill intake and exhaust ports with gasoline outdoors or indoors in conformance with fire prevention regulations. Valves and valve seats must be inspected if gasoline runs out of valve heads

Stem oversize	0 mm	0.1 mm	0.1 mm	0.2 mm
Valve head thickness oversize	0.25 mm	0.25 mm	0.50 mm	0.50 mm
For machining on seat insert	0.25 mm	0.25 mm	0.50 mm	0.50 mm
Identification on stem (see figure)	TRWT 11485 R0	TRWT 11485 R1	TRWT 11485 R2	TRWT 11485 R3



Location of valve identification

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C. DISASSEMBLING CRANKCASE

o Unscrewing Oil Filter Housing

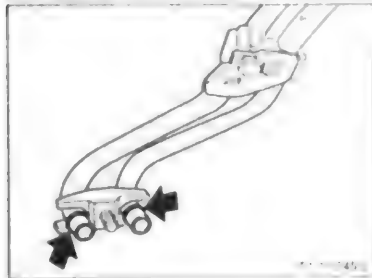
Unscrew oil cooler pipes

Installation:

Check arrangement of pipes

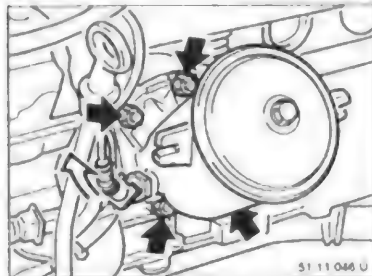
1 = Supply

2 = Return



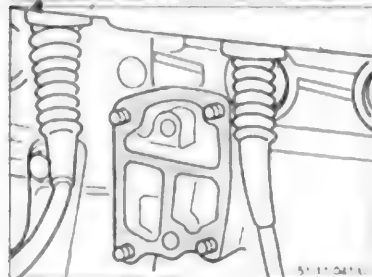
Installation:

Replace O-rings.



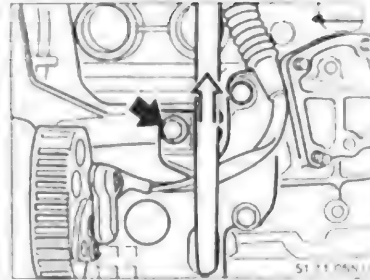
Disconnect plug.

Unscrew oil filter housing.



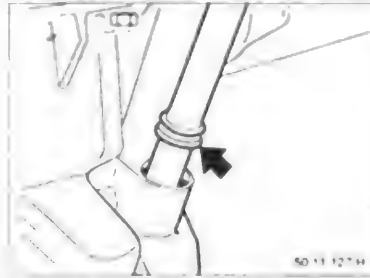
Installation:

Replace gasket.



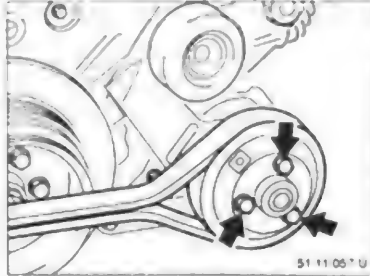
o Removing Oil Dipstick

Unscrew oil dipstick holder and pull oil dipstick out of oil pan



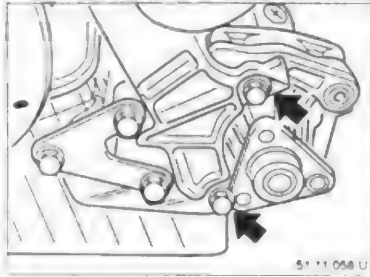
Installation:

Check O-ring



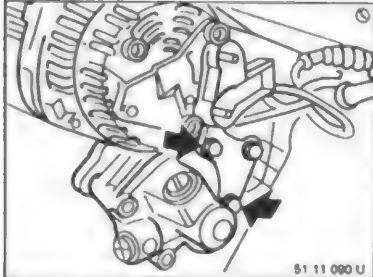
o Removing Power Steering Pump

Hold pulley tight with help of ribbed drive belt
Unscrew bolts.

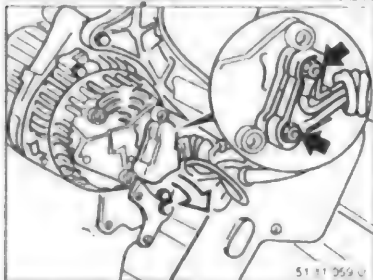


Unscrew bolts on face.

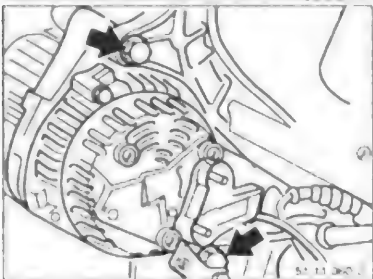
11-51/19



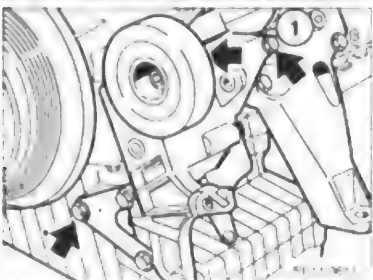
Unscrew bolts on back.



o Removing Alternator:
Pull cap off and disconnect wire harness connections.



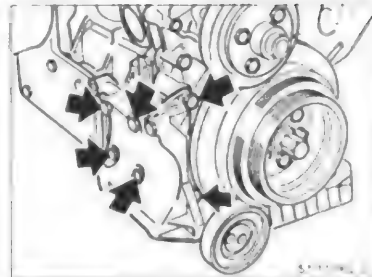
Unscrew alternator.



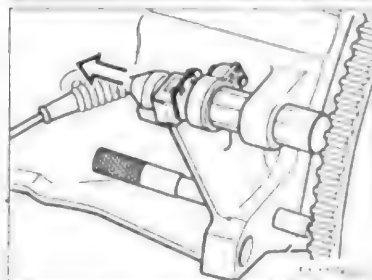
o Removing Console for Alternator and Power Steering Pump:

Unscrew bolts and remove console

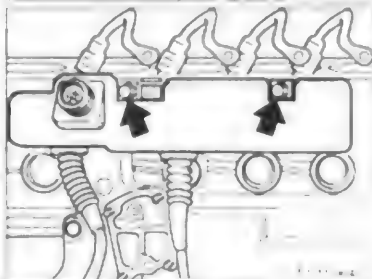
Installation:
Check dowel sleeve (1).



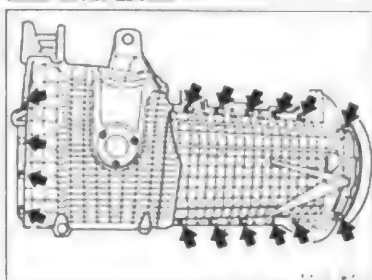
o Removing Console for A/C Pump:
Unscrew bolts.



o Removing Wire Harness from Engine:
Disconnect plug for speed sender

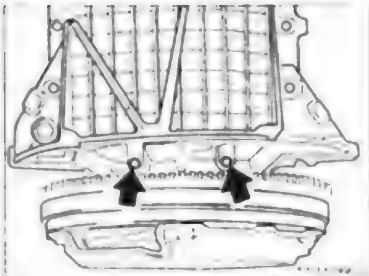


Unscrew wire harness from engine.

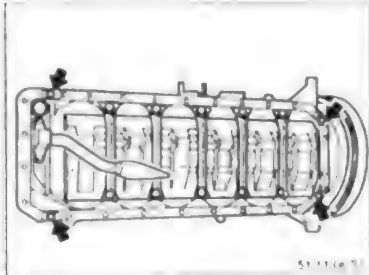


o Removing Oil Pan:
Unscrew bolts

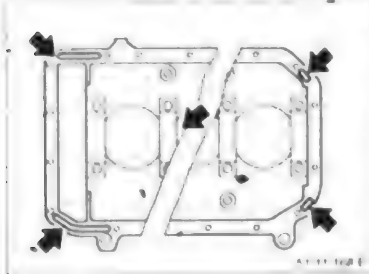
11-51/20



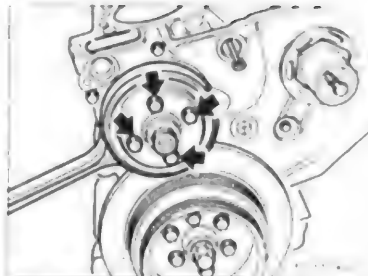
Unscrew bolts on transmission end and lift oil pan out.



Installation
Replace gasket.
Place gasket on oil pan or engine block and fill front and rear openings with a bead of permanently elastic sealing compound "black 3 Bond 12078" ** approx. 3 mm wide and 2 mm high.

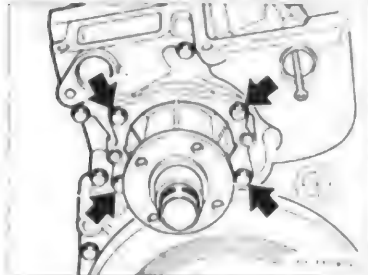


Versions of front and rear openings

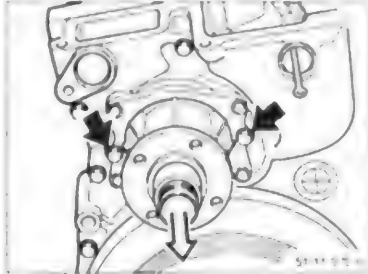


o Removing Water Pump

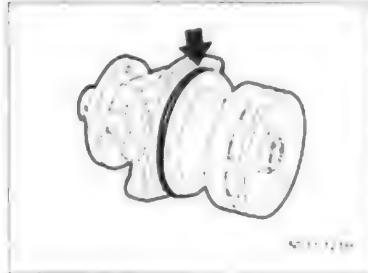
Hold pulley tight with ribbed drive belt and unscrew bolts



Unscrew bolts



Screw two M 6 bolts into tapped bores and press water pump out of end cover with uniform pressure.

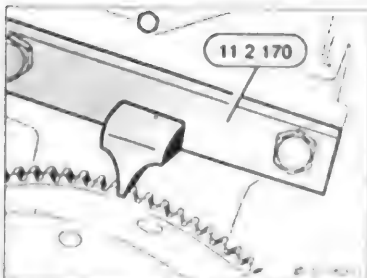


Installation
Replace O-ring and coat it with lubricant**

** Source of Supply: BMW Parts

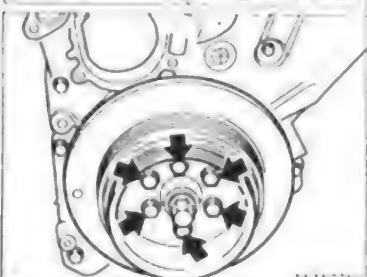
** Source of Supply: BMW Parts

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o Removing Vibration Damper

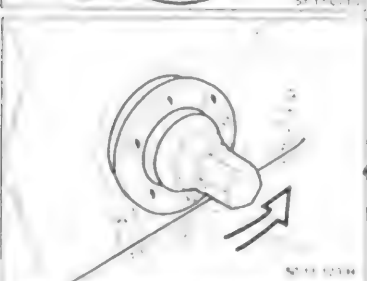
Block engine with Special Tool 11 2 170



Unscrew bolts on vibration damper and remove vibration damper

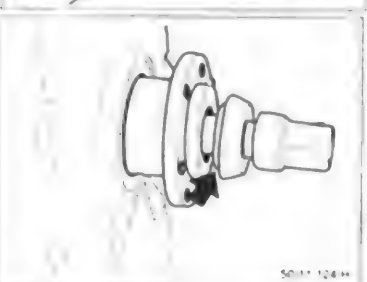
Installation:

Align dowel pin bore in vibration damper with dowel pin.



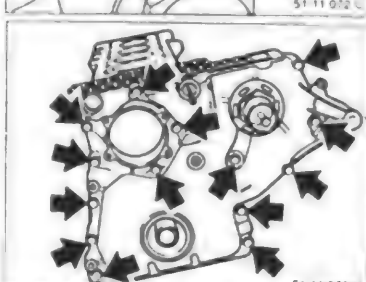
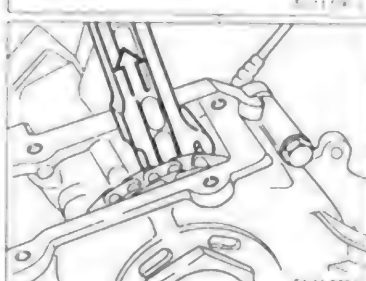
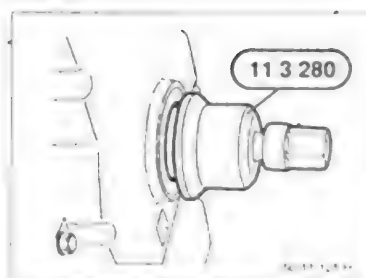
o Removing Vibration Damper Hub

Block flywheel with Special Tool 11 2 170
Unscrew central bolt.
Remove washer and hub



Installation:

Align groove of hub with woodruff key
Shoulder of washer faces hub
Tightening torque of central bolt:
1. 100 Nm torque force
2. 150° torque angle



Installation:

Press new radial oil seal in flush with Special Tool 11 3 280 in conjunction with the central bolt, with attached timing case cover

Note:

The central bolt could be too short in case of unfavorable tolerances. If necessary, use central bolt from a M50 engine

o Removing Chain Drive

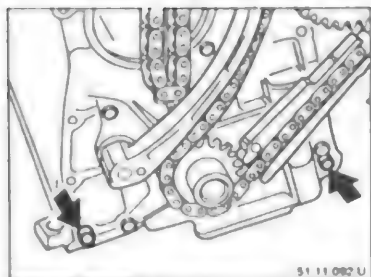
Important!

The injection pump or adapter for injection pump must be installed when working on the chain drive (the adapter is supplied with exchange engines as replacement for the pump).

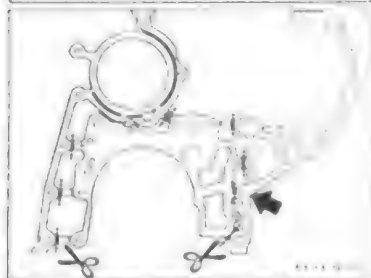
Pull upper guide rails upwards off of shaft bolts on the injection pump console

Unscrew timing case cover.

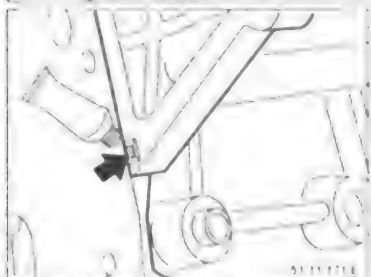
11-51/22



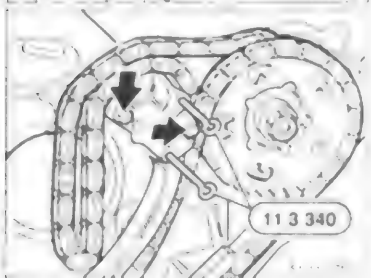
Installation
Check dowel sleeves



Installation
The gasket is only available for the timing case cover and oil pump together. Cut gasket off at the marked points for repairs on the timing case cover.



Important!
Fill the V-shaped recess in the seal for injection pump console with permanently elastic sealing compound** prior to installation of the gasket.



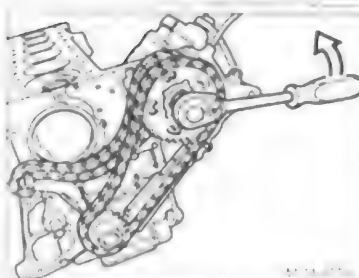
Press tensioning piston in downwards and lock with Special Tool 11 3 340. Unscrew chain tensioner.

Installation
Tightening torque*.

* Refer to Specifications
** Source of Supply: BMW Parts

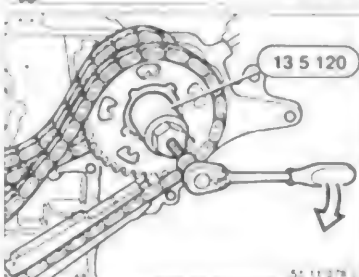


Caution!
Tensioning piston has strong spring force. Danger of injury while removing the special tool pins.

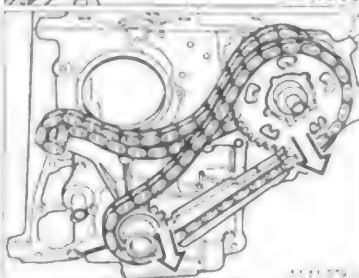


Remove sprocket bolt.

Installation
Tightening torque*.



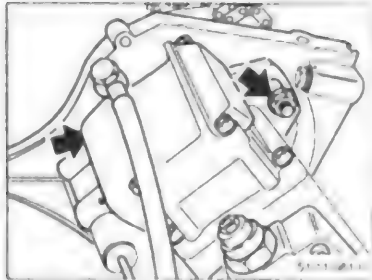
Screw Special Tool 13 5 120 with pressing-out bolt onto injection pump sprocket and press sprocket off.



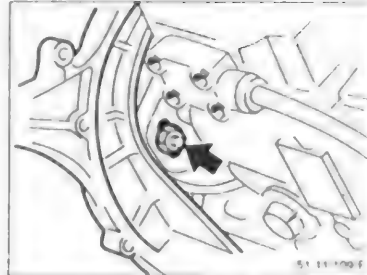
Remove both sprockets with mounted chain.

* Refer to Specifications

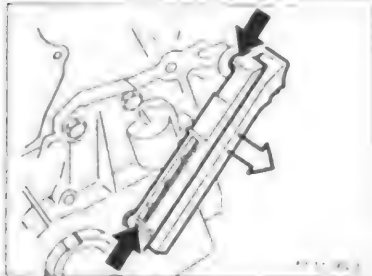
11-51/23



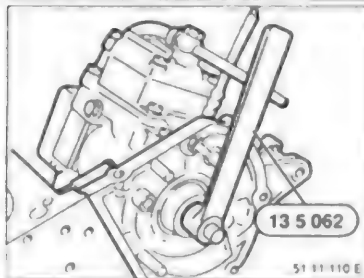
Unscrew injection pump bolts and remove injection pump.



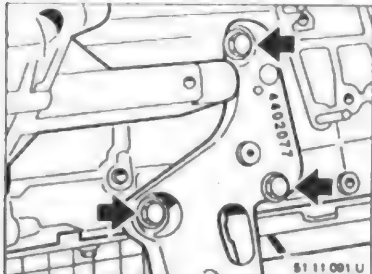
Secure injection pump in center of slot



Unclip lower chain guide

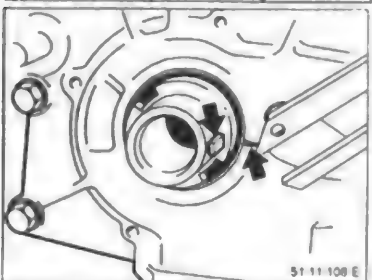


Set injection pump shaft to beginning of stroke in cylinder no. 1 using Special Tool 13 5 062 (the lever must point up vertically in front of the left cam)

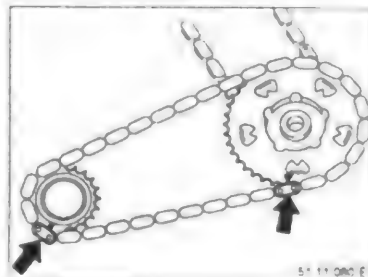


o Unscrewing Engine Mount Console
Unscrew bolts.

Place 80-link chain on the small toothed diameter of the injection pump sprocket
Place 74-link chain on the large toothed diameter of the injection pump sprocket and on the crankshaft sprocket.

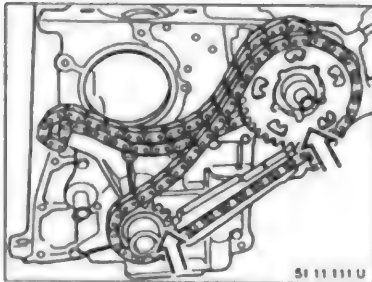


o Injection Pump Drive Chain Adjusting Procedures:
Turn crankshaft to position cylinder no. 1 to 26° before TDC (woodruff key on crankshaft points to mark on oil pump).

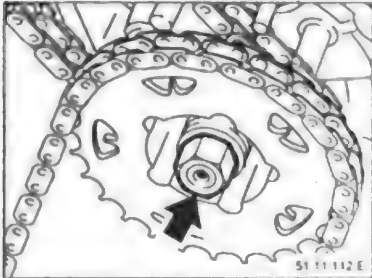


Important!
The 74-link chain has copper outside links at two points, which must be aligned with the tooth center marks on crankshaft and injection pump sprockets.

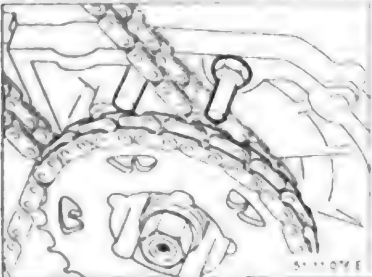
11-51/24



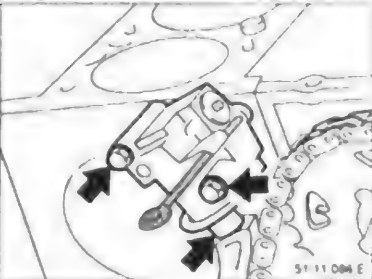
Push both sprockets with mounted chains mutually onto crankshaft and injection pump shaft.



Bolt sprocket to injection pump shaft.
Tightening torque*.

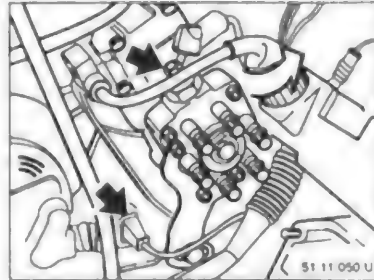


Note:
Pay attention to arrangement of camshaft chain between pins.

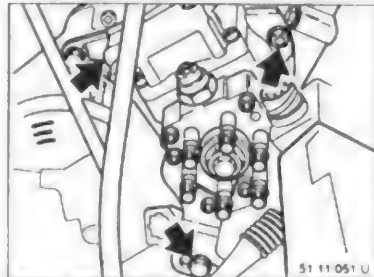


Bolt chain tensioner and remove lower special tool pin.

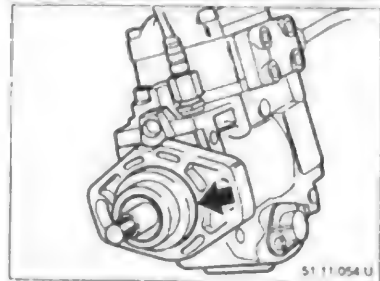
* Refer to Specifications



o Unscrewing Injection Pump:
Disconnect plugs.

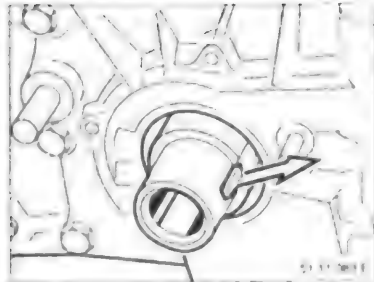


Unscrew pump.
Installation
Pay attention to shims

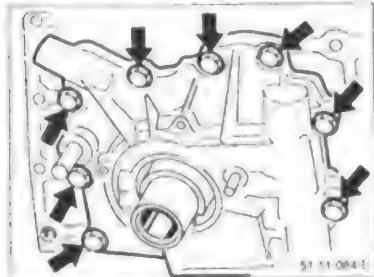


Installation
Replace O-ring.

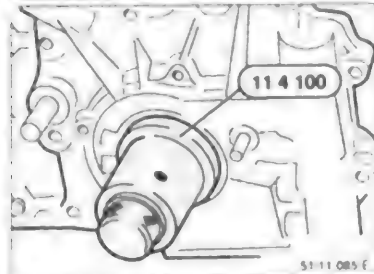
11-51/25



c Removing Oil Pump:
Lift woodruff key out.



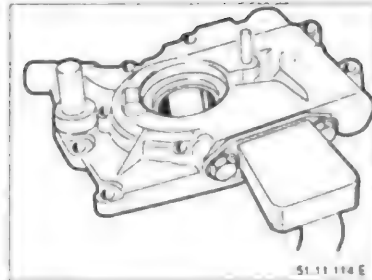
Unscrew oil pump bolts and lift oil pump off together with intake pipe.



Installation:
Screw in bolts loosely.
Center oil pump to crankshaft with Special Tool 11 4 100:
Screw special tool in as far as stop and then tighten bolts.



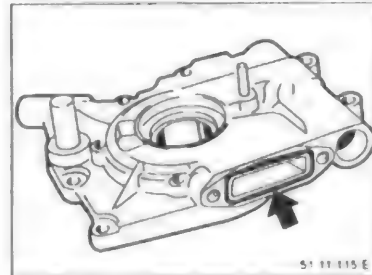
Caution!
Non-conformance will lead to pump rotor damage during operation.



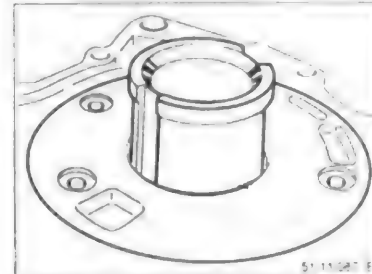
c Disassembling and Assembling Oil Pump:

Unscrew intake.

Important!
Intake is secured with self-tapping screws so that new pump bodies do not have tapped bores.
The threads can be cut with the available screws.

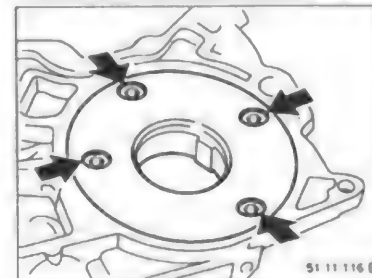


Installation:
Replace gasket.
Side with sealing bead points to intake.



Press bushing out.

Installation:
Collar of bushing faces crankcase.

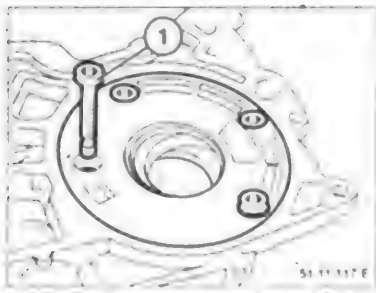


Unscrew screws and lift cover off.

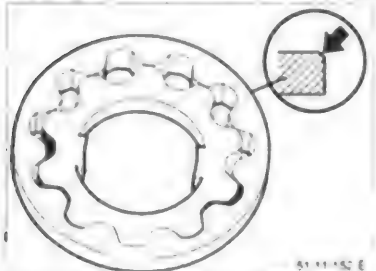
Installation:
Tightening torque*.

* Refer to Specifications

11-51/26

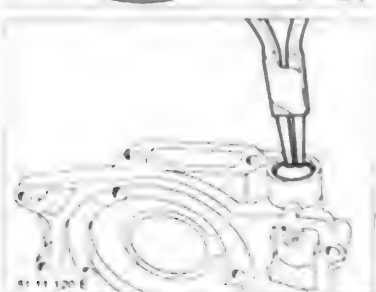


Installation:
Bolt (1) with M 7 threads is fitted with a journal and is simultaneously used to take the timing chain guide.



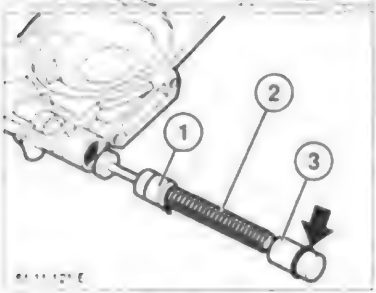
Inspect body and cover for wear and signs of scoring.

Installation:
Chamfer on outer rotor faces the body



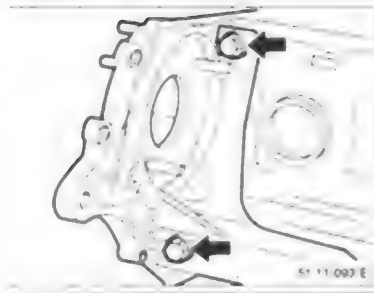
Press sleeve down lightly with help of a suitable mandrel!
LIR circlip out and remove pressure valve

Caution!
Strong spring force.

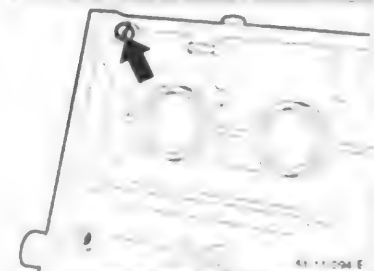


Installation:
1 = Piston
2 = Spring
3 = Sleeve

Note:
Check O-ring.
Measure length of relaxed spring (2).
Specified length = 84.1 mm.



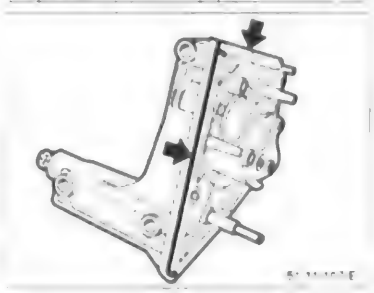
Removing Injection Pump Console
Unscrew bolts



Installation:
Pay attention to dowel sleeve

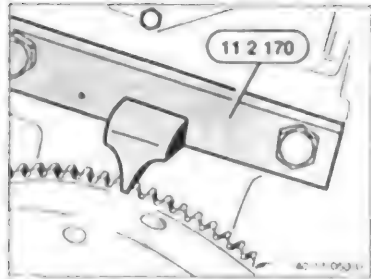


Align bottom of console to be flush on timing case cover gasket bearing surface with face of engine block.

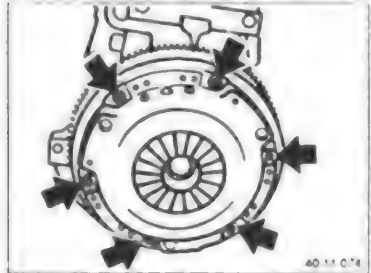


Installation:
Pay attention to gaskets

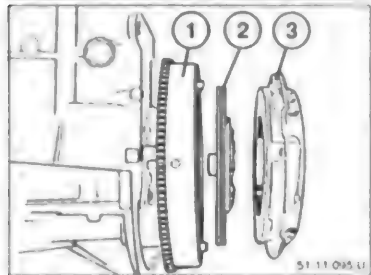
11-51/27



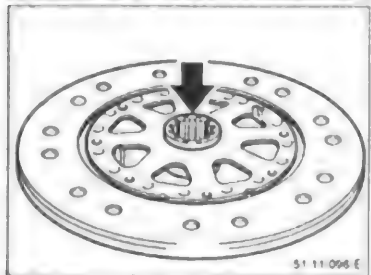
- o Removing Clutch/Flywheel:
Block flywheel with Special Tool 11 2 170.



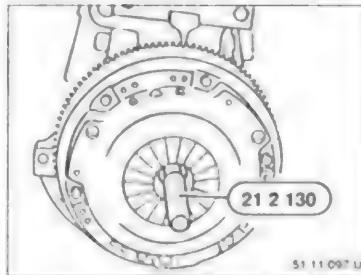
- Unscrew bolts uniformly
Remove pressure plate and drive plate
Installation:
Pay attention to dowel pins



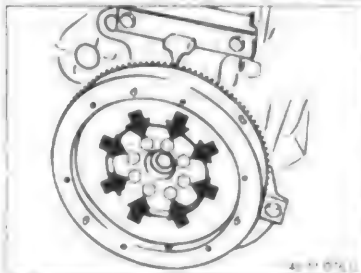
- Installation:*
1 = Flywheel
2 = Drive plate
3 = Pressure plate



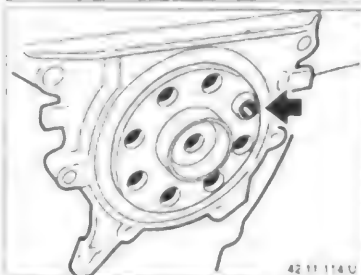
- Note:*
Flat side of drive plate (2) faces transmission



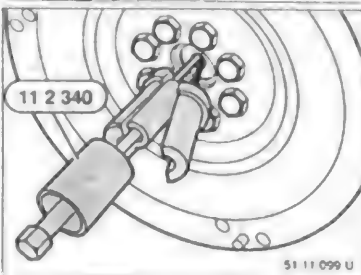
- Center drive plate with Special Tool 21 2 130 and tighten bolts in several steps
Tightening torque*



- Unscrew bolts and remove flywheel
Installation:
Clean tapped bores and install new bolts coated with micro-encapsulated cement
Tightening torque*



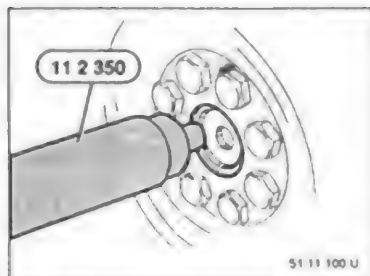
- Installation:*
Pay attention to dowel sleeve.



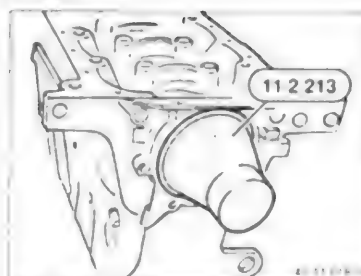
- o Replacing Pilot Bearing in Crankshaft:
Remove pilot bearing using Special Tool 11 2 340

* Refer to Specifications

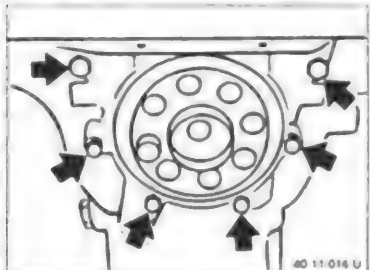
11-51/28



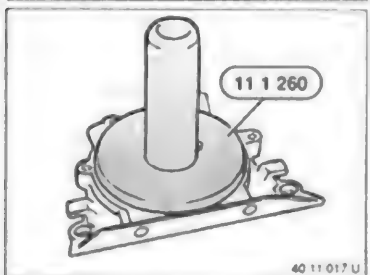
Installation:
Insert pilot bearing and drive it in as far as stop using Special Tool 11 2 350



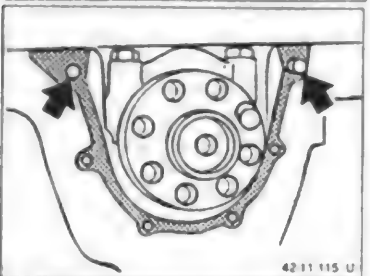
Installation:
Apply Special Tool 11 2 213 on crankshaft
Lubricate sealing lip of radial oil seal with oil
Push cover on and tighten bolts



o **Removing Rear End Cover**
Unscrew bolts and remove cover

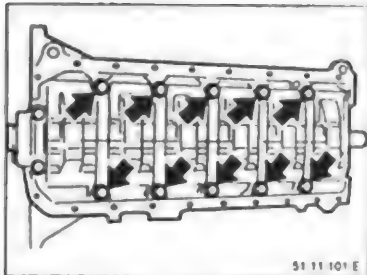


Installation:
Lift radial oil seal out and drive new seal in using Special Tool 11 1 260.



Installation:
Replace gasket.
Pay attention to dowel sleeves.

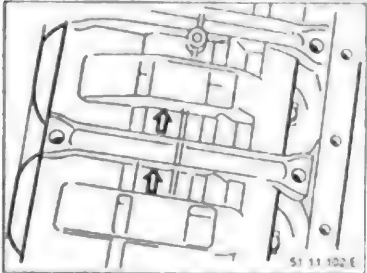
11-51/29



51 11 101 E

o Removing Conrod with Piston:

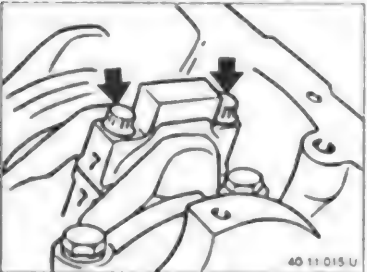
Uncrew oil splash plate.



51 11 102 E

Installation

Arrows point towards front end



40 11 015 U

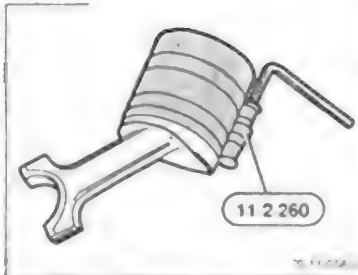
Uncrew conrod bearing cap.
Pull conrod with piston out to cylinder head side.



50 11 500 U

Important!

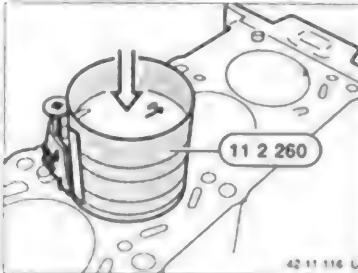
Reinstall piston, conrod and bearing shells in same position.
Conrods and bearing caps are marked with the same pair number — don't mix them up.



70 11 029 A

Installation

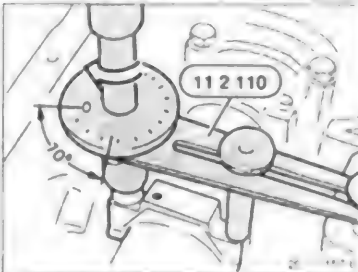
Lubricate piston and piston rings lightly with oil.
Align gaps of piston rings (approx. 120° offset, but not above piston pin bore).
Compress piston rings using Special Tool 11 2 260.



42 11 116 U

Installation

Install piston that arrow points to camshaft drive.
Compressing tool must bear firmly on crankcase all around.
Press piston in with help of light knocks (e.g. from handle of hammer).
Bring crankshaft journal and connecting rod together at same time.



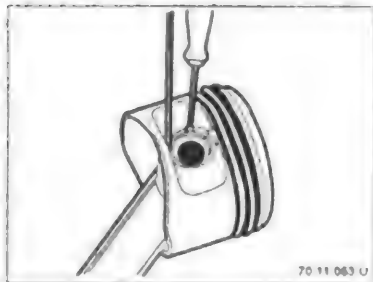
25 11 010 C

Installation

Conrod bolt tightening procedures:
Lubricate conrod bearing shells with oil.
Mount bearing cap that pair numbers are matched.
Install new conrod bolts.
Tighten conrod bolts in two steps.

Step 1: 20 Nm torque force
Step 2: 70° torque angle

11-51/30



70 11 063 U

Removing / Checking / Repairing Connecting Rods:

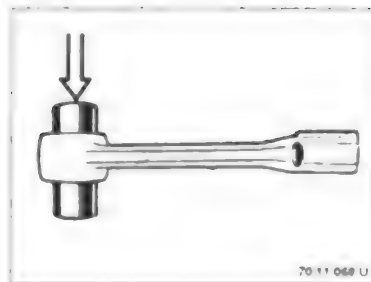
Lift circlip out and press piston pin out

Important!

Pistons and piston pins are matched and must not be mixed up.

Installation:

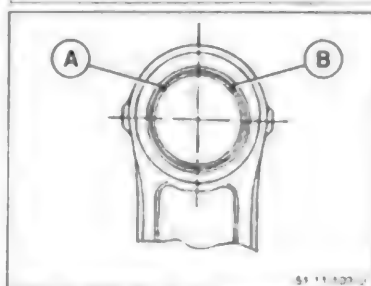
Insert circlip in such a manner that gap is opposite the opening.



70 11 069 U

Checking Piston Pin Bush:

It must be possible to pass the piston pin through the bush by hand with slight force and no play should be noticed.

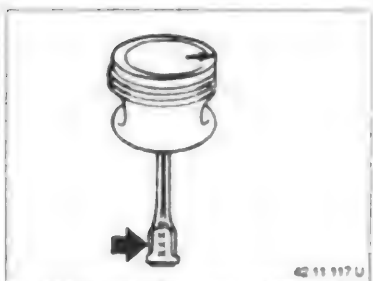


51 11 100 U

Replacing Piston Pin Bush:

Press old bush out using a suitable mandrel (28.5 mm dia.).

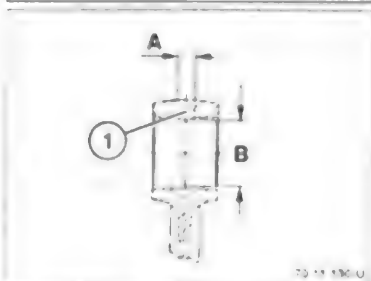
Press new bush in with bush gap optionally at point A or B.



42 11 917 U

Installation:

Install connecting rod on piston in such a manner that installed direction arrow on the piston points to the right when the pair number is visible.



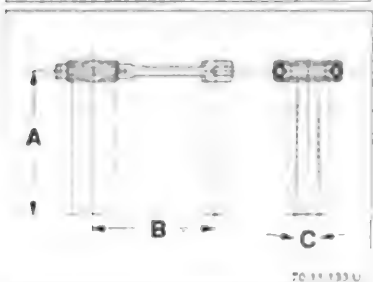
70 11 130 U

Drill oil bore (1)

(A = same bore diameter as in conrod).
Remove burrs from both ends of bore.
Ream bush dry to diameter B = 27.008 ... 27.014 mm with a reamer.

Note:

Break of lubricating groove points in direction of conrod gap



70 11 133 U

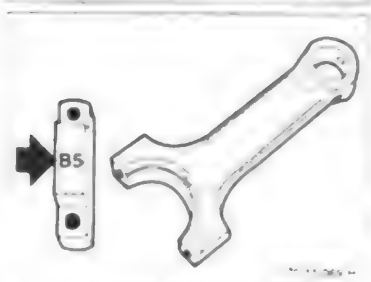
Checking Connecting Rod:

Inspect connecting rod for parallel deviation and distortion.

A = Test distance: 150 mm

B = Max. permissible parallel deviation at distance A: 0.04 mm

C = Max. permissible distortion to one side: 0° 30'



70 11 134 U

Replacing Connecting Rod:

Note:

Only connecting rods of the same weight class (die-stamped in bearing cap) may be installed in one engine.

Connecting rods are only supplied in sets by Parts.

11-51/31



Replacing Conrod Bearing Shells

Different version bearing shells are used in standard production for "Low Version" and "High Version" engines.

"Low Version" (85 kW):
Normal bearing shells.

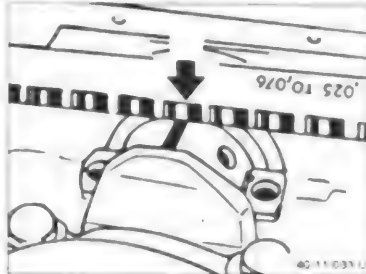
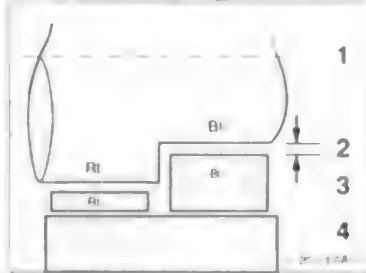
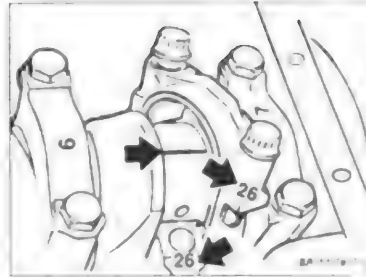
"High Version" (105 kW):
Conrod bearing caps – normal bearing shells.
Conrods – wear-proof bearing shells (sputter bearing shells).

The wear-proof bearing shell is also marked with a die-stamped "S" on the outside of the bearing shell.

Only "High Version" bearing shells are available from Parts.
They must be installed in both engine versions for replacements.

Install one each red and blue bearing shell for each connecting rod regardless of the color code on the conrod shank.

Important!
Pay attention to ground size.
Refer to "Replacing Crankshaft Bearing Shells".



Installation

Check conrod bearing play.
- This work need only be carried out for controlling purposes when necessary -

Place Type PG 1 Plastigage** on crankshaft, wiped clean of oil with piston in BDC. Mount bearing cap and secure with old conrod bolts tightened to specified torque.

Important!

Don't turn conrod or crankshaft.

Survey of Color Code - Shell Diameter
Bearing Shell Thickness*

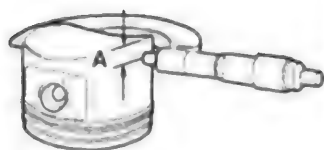
Double Classification Color Codes
Rt = Red
Bl = Blue

- 1 - Crankpin
- 2 - Bearing play
- 3 - Bearing shell thickness
- 4 - Conrod end

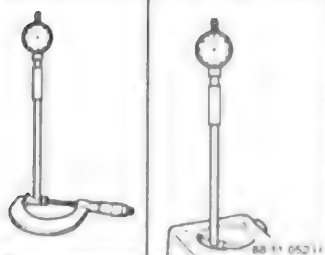
Remove bearing cap and read bearing play (specification: 0.020 ... 0.055 mm) by measuring width of flattened Plastigage with help of supplied scale.
Correct the bearing play by installing either new bearing shells or bearing shells with a different color code.

* Refer to Specifications
** Source of Supply: Cartool

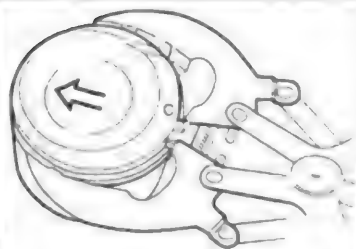
11-51/32



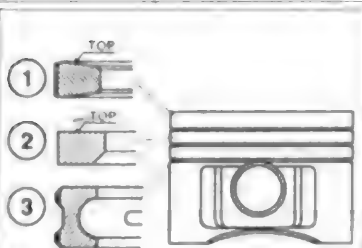
30 11 051 U



68 11 052 U



70 11 065 U



51 11 106 U

Replacing / Checking Pistons:

Installation:

Measure piston installed clearance before installing.
Measure piston diameter at distance A = 7 mm from lower edge of piston and offset 90° from piston pin axis using a micrometer.

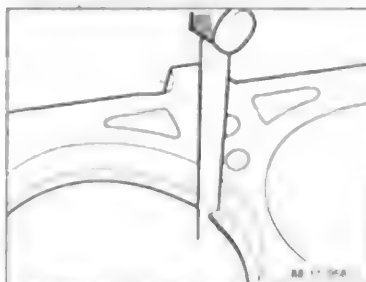


70 11 067 M

Set internal calipers to zero with measured piston diameter on the micrometer.
Measure cylinder bore diameter at bottom, middle and top diagonally.

New piston installed clearance:
0.031 ... 0.063 mm

Max. total wear clearance
0.15 mm



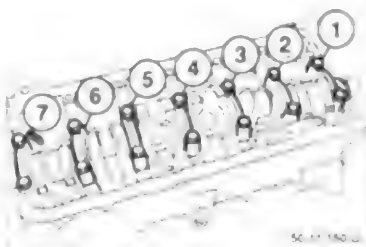
68 11 052 U

Replacing / Checking Piston Rings:

Remove piston rings using piston ring compressing pliers.

Note:

It might not be possible to read the identification of used piston rings.
Consequently lay piston rings aside in correct sequence and installed location.



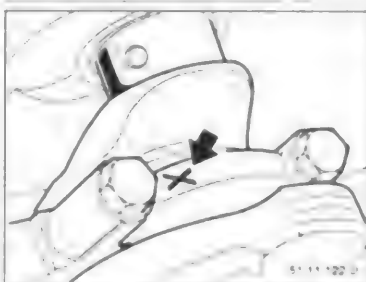
50 11 160 U

Installation:

Install piston rings with "TOP" facing the piston crown.

- 1 - Double-sided keystone ring
- 2 - Taper face ring
- 3 - Bevelled ring with hose-lined spring

Offset piston ring gaps by about 120° to each other, but do not position them above the piston pin bore.



51 11 102 U

Measuring side clearance:

Specifications:

Groove 1 = measuring not necessary
Groove 2 = 0.040 ... 0.087 mm
Groove 3 = 0.05 ... 0.065 mm
Max. permissible total wear = 0.025 mm

Measuring end clearance:

Specifications:

Groove 1 = 0.2 ... 0.4 mm
Groove 2 = 0.2 ... 0.4 mm
Max. permissible total wear = 0.05 mm

Removing Crankshaft:

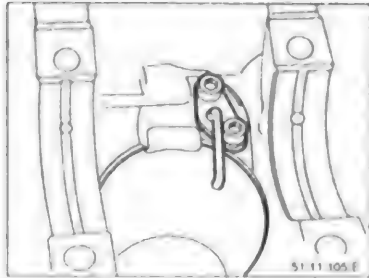
(refer to 11 21 501 for replacing crankshaft)

Unscrew and remove main bearing caps (1 ... 7) and lift crankshaft out.

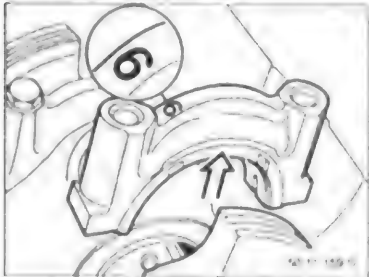
Installation:

The bearing caps are marked with die-stamped numbers from 1 to 5 on the "exhaust side".
Bearing caps 6 (thrust bearing) and 7 are not marked.

11-51/33

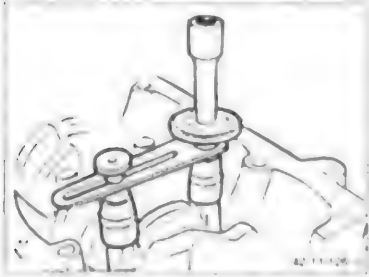


The oil spray nozzles are mounted on the crankcase without gaskets.
If necessary, check flow and sprayed direction.



Installation
Lubricate bearing shells with oil.
Install crankshaft.
Mount bearing caps (1 ... 7) in such a manner that grooves of bearing shell guides are on one side.
Align bearing caps precisely.

Installation
The thrust bearing shells are installed at bearing (6).

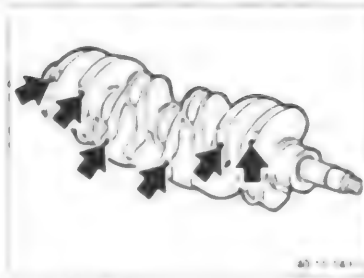


Main bearing cap tightening procedures

Tighten bolts (washed and oiled) in two steps.

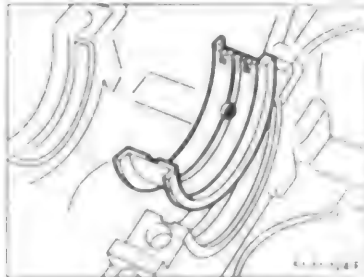
Step 1 = 23 Nm torque force
Step 2 = 50° torque angle

Note
Make sure that oil is kept out of tapped bores.



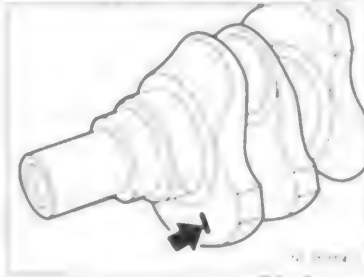
6 Replacing Main Bearing Shells

The crankshaft is marked with yellow, green or white paint depending on main bearing journal tolerances.



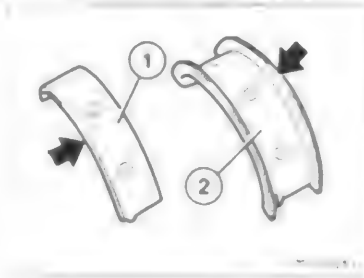
In standard production the thrust bearing only uses a shell on the case end.

For repairs thrust bearing shells must be used in the cap and case similar to the M21 engine.



Important!
Pay attention to ground size* of crankshaft.

1 paint stripe Size 1 (0.25 mm)
2 paint stripes Size 2 (0.50 mm)



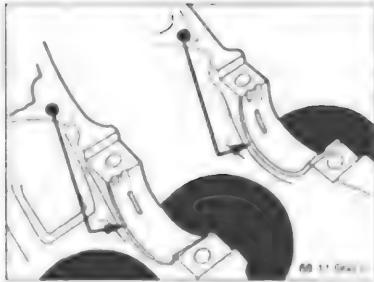
The bearing shells are marked with yellow, green or white paint.

1 = Bearing shell
2 = Thrust bearing shell

Pay attention to ground size of main bearing journal.

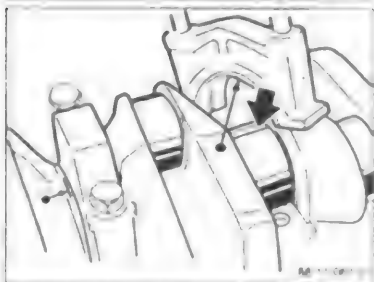
* Refer to Specifications

11-51/34



Install bearing shell with yellow paint mark in crankcase.

Install bearing shell with same color paint mark as that of crankshaft in bearing cap.

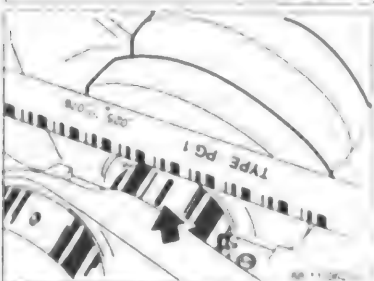


Check conrod bearing play.

- This work need only be carried out for controlling purposes when necessary.

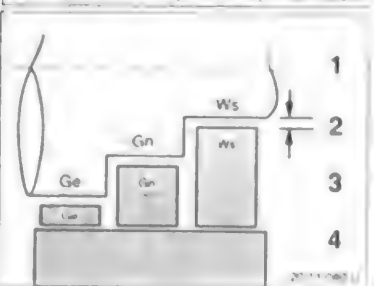
Install crankshaft.

Place Type PG-1 Plastigage** on crankshaft, wiped clean of oil and tighten bearing cap bolts to specified torque*.
Don't turn the crankshaft.



Remove bearing cap and read bearing play* by measuring width of flattened Plastigage with help of the supplied scale.

Correct the bearing play by installing either new bearing shells or bearing shells with a different color paint mark.



Survey of Color Codes - Shaft Diameters
Bearing Shell Thickness*

Triple Classification Color Codes

Ge = Yellow

Gn = Green

Ws = White

1 = Crankshaft diameter

2 = Bearing play

3 = Bearing shell thickness

4 = Bearing support diameter

* Refer to Specifications

** Source of Supply: Cartool

11 Engine M60

11 00 603	Engine – disassemble and assemble	11- 60/1
	General information	11- 60/1
	Engine – mount on assembly stand	11- 60/1
	Exhaust manifolds – remove	11- 60/1
	Cylinder head – remove	11- 60/3
	Engine wire harness – remove	11- 60/3
	Ribbed belt – remove	11- 60/4
	Belt tensioner – remove	11- 60/4
	Intake manifolds – remove	11- 60/4
	Cylinder head covers – remove	11- 60/5
	Oil filter – remove	11- 60/6
	Oil dipstick guide tube – remove	11- 60/7
	Upper timing case cover (bank of cylinders 1-4) – remove	11- 60/7
	Upper timing case cover (bank of cylinders 5-8) – remove	11- 60/9
	Timing chain sprockets – remove	11- 60/10
	Camshaft adjusting procedures	11- 60/11
	Cylinder head (bank of cylinders 1-4) – remove	11- 60/14
	Cylinder head (bank of cylinders 5-8) – remove	11- 60/15
	Cylinder head gasket – replace	11- 60/16
	Cylinder head – disassemble and assemble	11- 60/17
	Cylinder head – mount on assembly stand	11- 60/17
	Camshafts (bank of cylinders 1-4) – remove	11- 60/17
	Camshafts (bank of cylinders 5-8) – remove	11- 60/20
	Bucket tappets with hydraulic valve clearance compensators – remove	11- 60/22
	Intake and exhaust valves – remove	11- 60/22
	Cylinder head – check for cracks in water test	11- 60/24
	Cylinder head sealing surface – inspect	11- 60/24
	Valve guides and seats – machine	11- 60/24
	Valve guides – ream	11- 60/24
	Valve seats – machine	11- 60/25
	Crankcase – disassemble and assemble	11- 60/26
	Oil pan lower section – remove	11- 60/26
	Oil pan upper section – remove	11- 60/26
	Alternator – remove	11- 60/27
	Vibration damper – remove	11- 60/27
	Front radial oil seal – replace	11- 60/28
	Water pump – remove	11- 60/28
	Lower timing case cover – remove	11- 60/29
	Timing chain guide – remove	11- 60/29
	Oil pump – remove	11- 60/31
	Oil pressure regulating piston – remove	11- 60/32
	Connecting rods and pistons – remove	11- 60/33
	Connecting rods – remove	11- 60/34
	Conrod bearing shells – replace	11- 60/35
	Pistons – replace	11- 60/35
	Piston rings – replace/check	11- 60/35
	Clutch / flywheel – remove	11- 60/36
	Pilot bearing in crankshaft – replace	11- 60/38
	Rear end cover – remove	11- 60/38
	Crankshaft – remove	11- 60/39
	Main bearing shells – replace	11- 60/41

11-60/1

11 00 603 DISASSEMBLING AND ASSEMBLING ENGINE - Engine Removed -

o General Information

- Cylinder Arrangement:

Looking forward in the car cylinders 1 ... 4 are located on the right-hand side (beginning with cylinder no. 1 at the front end)

Looking forward in the car cylinders 5 ... 8 are located on the left-hand side (beginning with cylinder no. 5 at the front end)

General Information for Valve Timing Work:

If work had been carried out on the cylinder head, for which the camshaft was removed, the must be compliance with the following

The hydraulic valve tappets expand without load from the camshaft and require a certain amount of time to be compressed again after installation. Consequently in case of fast installation even the "closed" valves could be opened and touch the pistons.

The following waiting times are necessary between installation of the camshaft and mounting cylinder head:

Room temp. (20° C)	4 minutes
10 to 20° C	11 minutes
0 to 10° C	30 minutes

After installation of the camshaft and timing chain the engine may first be cranked after the following waiting times:

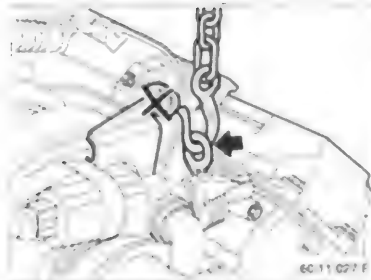
Room temp. (20° C)	10 minutes
10 to 20° C	30 minutes
0 to 10° C	75 minutes

Always pay attention to the camshaft adjusting procedures when working on the valve train with mounted cylinder heads.

Disassembling and repairing the engine are described in chronological sequence on the following pages. The list of contents is provided to help take up work again after an interruption or to more easily find a certain point. They only describe direct removal and installation, and do not contain full details of procedures

If applicable, drain the engine oil and fill the engine with new oil after assembling the engine.

Check the engine oil level after installation and trial run.

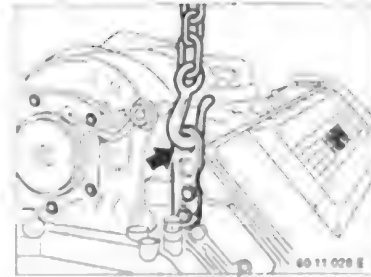


o Mounting Engine on Assembly Stand

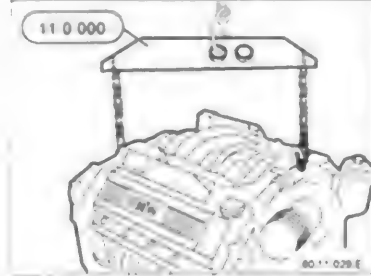
Important!

Only lift engine on the suspension eyes provided for this purpose

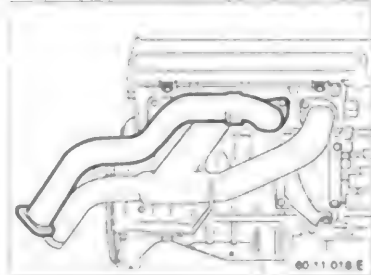
Front Engine Suspension



Rear Engine Suspension



Lift engine using Special Tool 11 0 000.

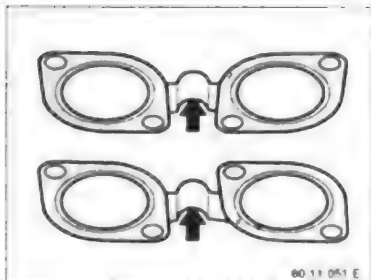


o Removing Exhaust Manifolds

Installation

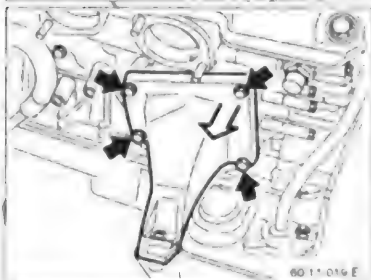
The exhaust manifold for cylinders 1 and 3 has to be mounted first because of accessibility to exhaust manifold bolts.

11-60/2



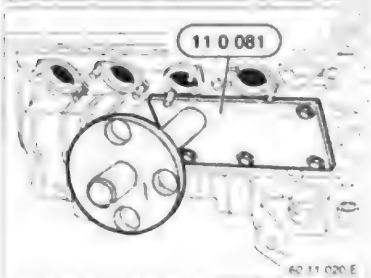
60 11 051 E

Installation
Replace gasket — the gasket bead points to the exhaust manifold.



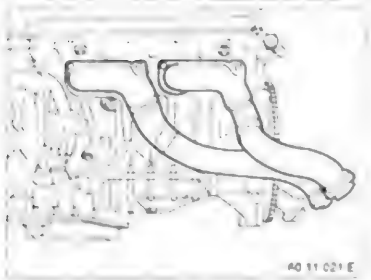
60 11 016 E

Unscrew engine carrier at cylinder bank 1...4 side.



60 11 020 E

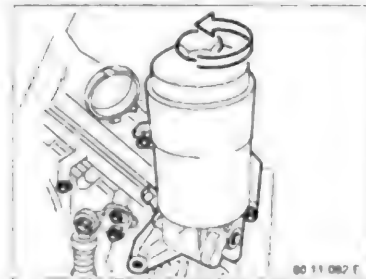
Mount Special Tool 11 0 081 on cylinder bank 1...4 side.



60 11 021 E

Unscrew exhaust manifold for cylinder bank 5...8.

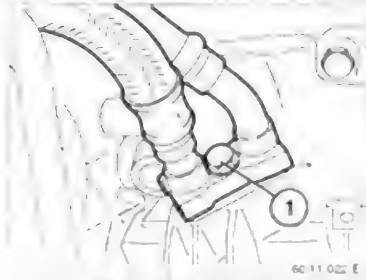
Installation
Replace gasket — the gasket bead points to the exhaust manifold.



60 11 082 E

Loosen oil filter cover to let the oil run out of the oil filter housing into the oil pan.

Installation
Always use a socket for loosening and tightening to prevent damage to the hexagon of the oil filter cover.
Tightening torque*



60 11 022 E

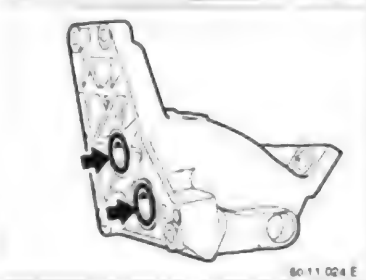
Remove oil filter pipes.
Unscrew bolt (1) and lift out pipes upwards.

Installation
Check seals, replacing if necessary.



60 11 023 E

Unscrew engine carrier with oil connectors.



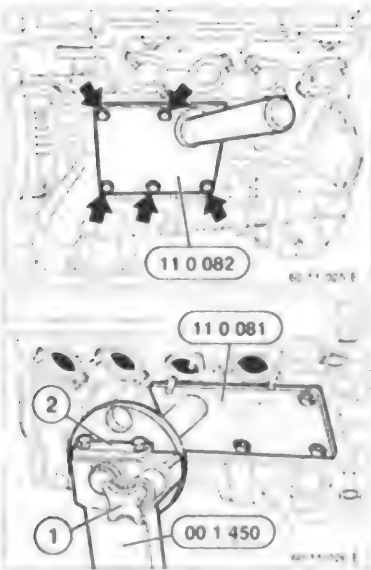
60 11 024 E

Installation
Replace seals.
Check for correct seating of seals and, if necessary, hold them in position with grease.

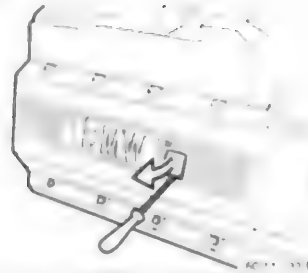
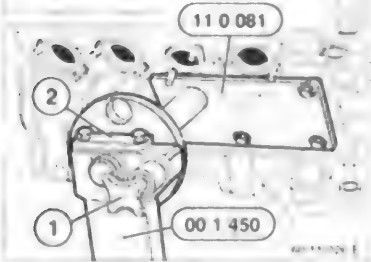
* Refer to Specifications

11-60/3

Mount Special Tool 11 0 082



Place engine with attached Special Tools 11 0 081 and 11 0 082 in Special Tool 00 1 450 (assembly stand) in such a manner that arrest (1) engages. Lock left and right arrests (2) and bolt.

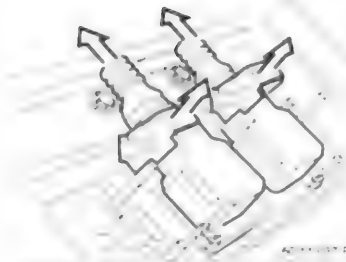


REMOVING CYLINDER HEAD

o Removing Engine Wire Harness

Lift out cover and unscrew nuts
Remove cover for ignition coils

Disconnect plugs on ignition coils



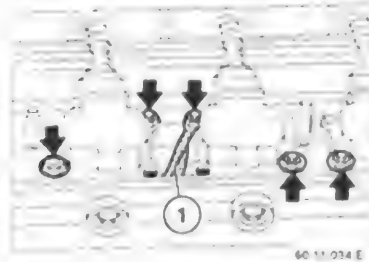
Unscrew nuts from left and right wire duct
Disconnect all plugs
Lift off wire harness

Refer to Group 12 for plug pin connections



Unscrew nuts
Remove ignition coils

Installation
Secure ground strap (1) at the ignition coils for cylinders 3 and 7.



11-60/4

c Removing Ribbed Drive Belt

Ribbed Drive Belt Layout

Installation

Check the ribbed drive belt for traces of coolant and oil, replacing it if necessary.

Important!

It is absolutely necessary to replace a ribbed drive belt dirtied with hydraulic oil.

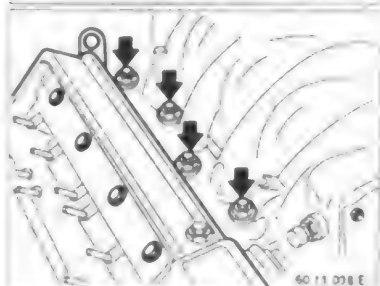
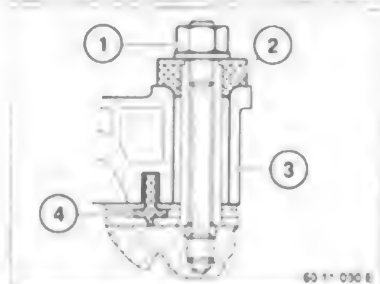
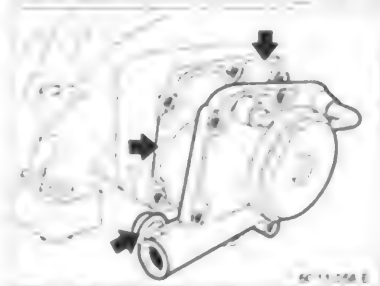
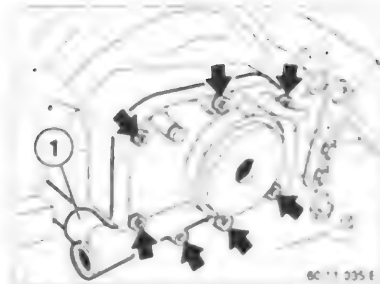
Loosen nuts (1 and 2) to remove tension from the drive belt

Installation

Install the ribbed drive belt and check for correct position on the pulleys. Pre-tension the adjusting plate up to the end of slot (2) on hexagon (1). Tighten nuts (3).

c Removing Drive Belt Tensioner

Unscrew nuts (1) and bolt (2). Remove complete belt tensioner.



c Removing Intake Manifolds

Important!

First unscrew the cover with pressure regulating valve as otherwise vent pipe (1) would be damaged.

Installation

Check seal and gasket, replacing if necessary.

Note

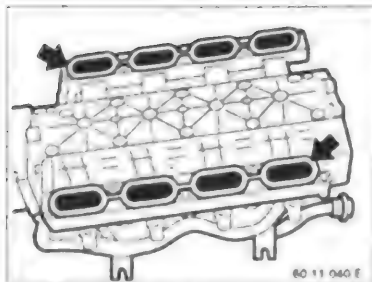
Rubber mounts and gaskets separate the intake manifold from the cylinder head in regards to oscillation.

Arrangement:

- 1 Nut
- 2 Decoupling element (rubber mount)
- 3 Intake manifold
- 4 Gasket

Unscrew left and right nuts. Lift off intake manifold.

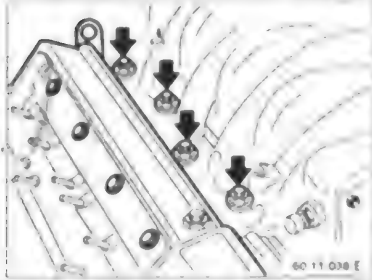
11-60/5



60 11 040 E

Installation

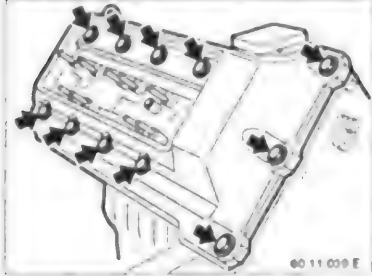
Check gaskets, replacing if necessary
Check for correct seating of gaskets



60 11 038 E

Installation

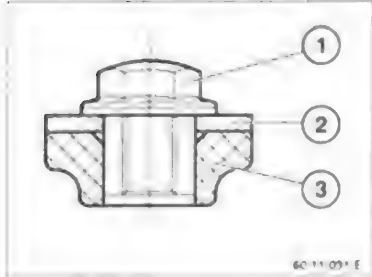
Screw in two mounting elements still without pre-load on left and right sides and align the intake manifold.
Screw in all other mounting elements and tighten diagonally from inside to outside.
Tightening torque*.



60 11 039 E

• Removing Cylinder Head Covers

Unscrew cover nuts.
Lift off covers.



60 11 051 E

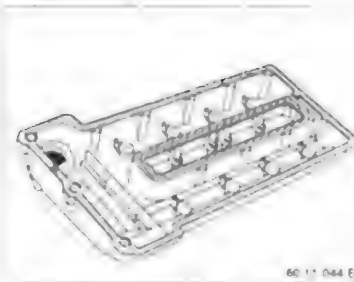
Note

Rubber mounts and gaskets separate the cylinder head cover from the cylinder head in regards to oscillation.

Arrangement:

- 1 Nut
- 2 Washer
- 3 Rubber mount

* Refer to Specifications

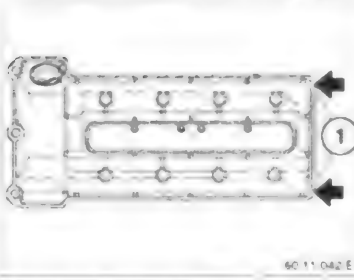


60 11 044 E

Installation

Check gasket, replacing if necessary

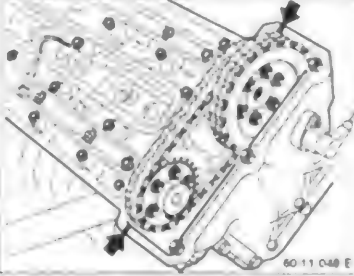
Coat the outer and inner grooves as well as sealing surface of the cylinder head cover all around with a rubber lubricant, e.g. glycerine** or something similar.
Press the inner gasket into the cover groove free of distortion, beginning at the four corners.



60 11 042 E

Installation

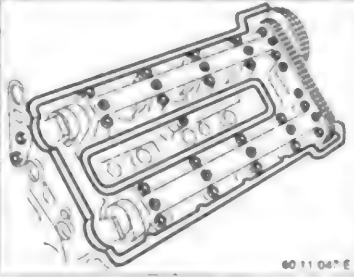
Line up the outer gasket loose on the cover groove.
Press the gasket into the cover groove free of distortion, beginning at the rear corner radii (1).



60 11 048 E

Installation

Coat the butt joint surfaces with fluid sealing compound - Hylomar SQ32 Special**.



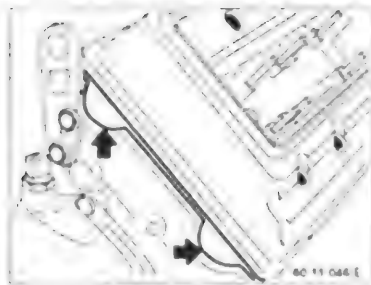
60 11 041 E

Installation

Coat the sealing surface on the cylinder head over the entire rear face side including both half-moons with rubber lubricant, e.g. glycerine** or something similar.
Mount the cylinder head cover with gasket on the cylinder head.

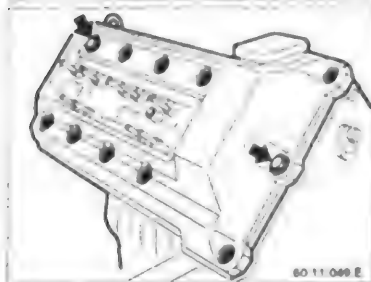
** Source of Supply: BMW Parts

11-60/6



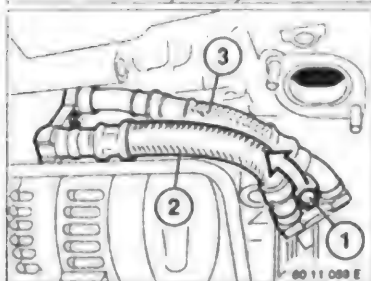
Installation

Check for correct seating of the gasket on the cylinder head when mounting the cylinder head cover – pay attention to the back.



Installation

Screw in two mounting elements at points of location still without pre-load and align the cover.
Screw in all other mounting elements and tighten diagonally to 10 Nm from inside to outside.



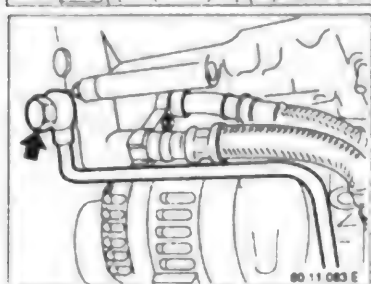
o Removing Oil Filter

Unscrew oil pipes from carrier.
Unscrew bolt (1) and lift out pipes upwards.

Installation:

Check seals, replacing if necessary.
Note arrangement of oil hoses.

- 2 Used oil
- 3 Fresh oil

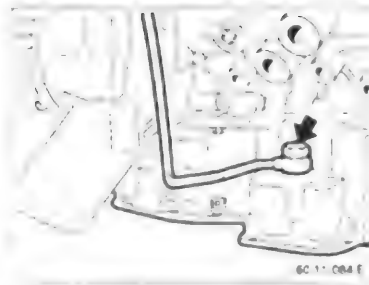


Unscrew oil drain pipe at oil filter.

Installation:

Check seal, replacing if necessary.
Tightening torque*.

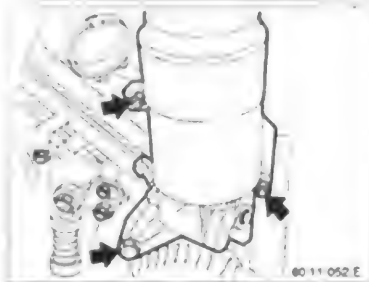
* Refer to Specifications



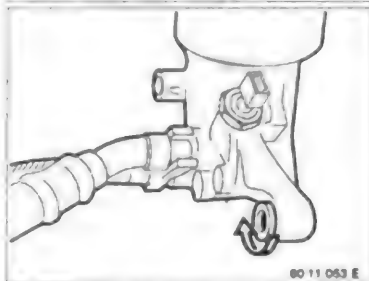
Unscrew oil drain pipe at oil pan

Installation

Check seal, replacing if necessary.
Tightening torque*.

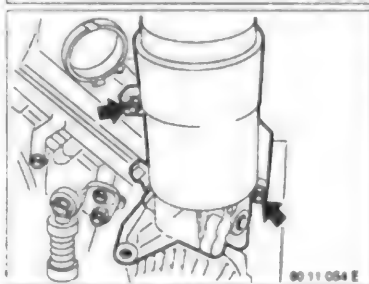


Unscrew bolt and nuts
Remove oil filter



Installation

Turn back hexagon into oil filter completely using a hexagon key.

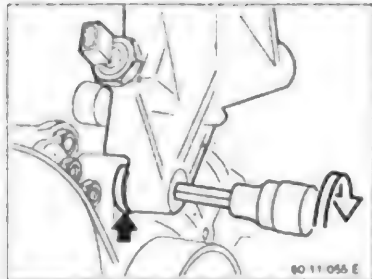


Installation:

Secure with both nuts on the upper timing case cover.

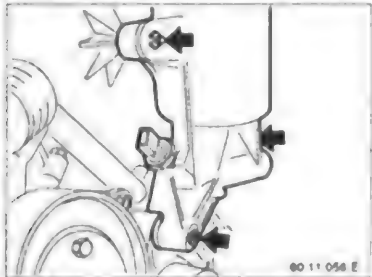
* Refer to Specifications

11-60/7



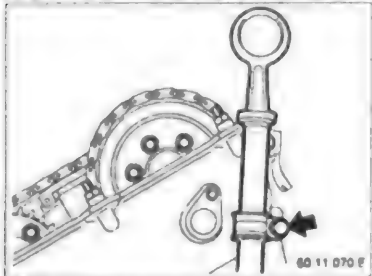
60 11 056 E

Installation:
Turn the adjusting hexagon against the alternator free of play using a hexagon key, but "do not pre-load".



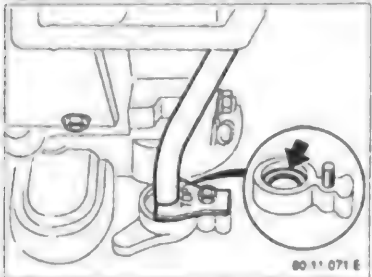
60 11 056 E

Installation:
Install bolts and tighten all mounting elements.



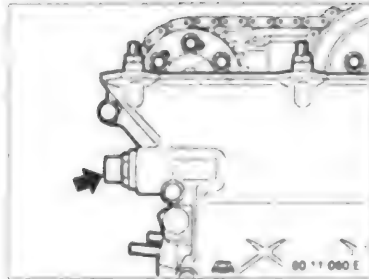
60 11 070 E

o **Removing Oil Dipstick Guide Tube**
Unscrew clamp.



60 11 071 E

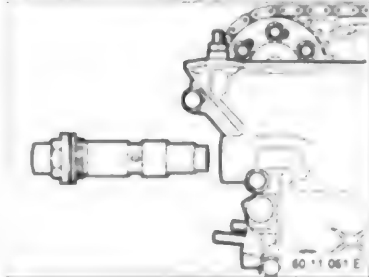
Unscrew nut.
Installation:
Check seal.



60 11 080 E

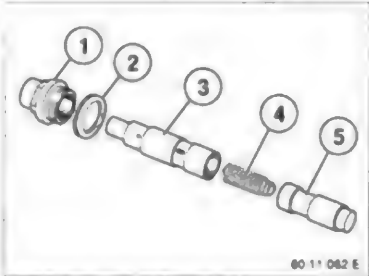
o **Removing Upper Timing Case Cover**
Cylinder Bank 1...4

Unscrew chain tensioner mounting element.



60 11 081 E

Remove complete mounting element and hydraulic tensioner.

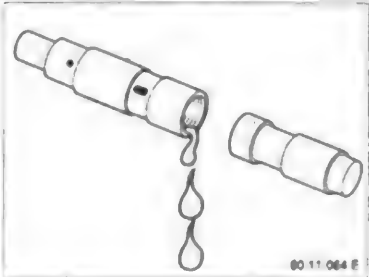


60 11 082 E

Arrangement of Parts:

- 1 Plug
- 2 Seal
- 3 Cylinder
- 4 Return spring
- 5 Hydraulic plunger

Installation:
Conical end of return spring (4) points to hydraulic plunger (5).

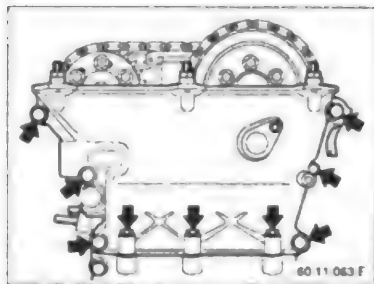


60 11 084 E

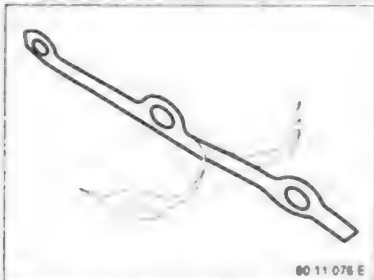
Installation:
Empty the oil chamber between the cylinder and hydraulic plunger to make installation easier.
Replace gasket.
Tightening torque*.

* Refer to Specifications

11-60/8

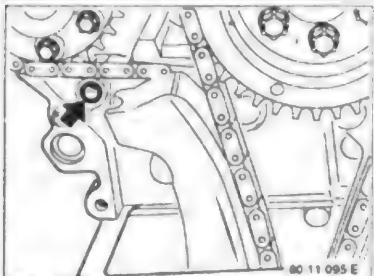


Unscrew mounting elements on timing case cover.

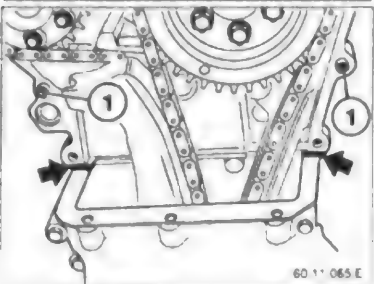


Installation:
Clean sealing surfaces to remove dirt and oil.
Replace gasket.

Important!
Pull off protective sheet.

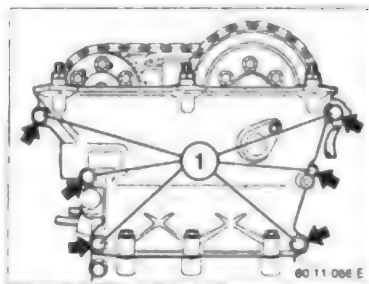


Important!
Supply of oil for hydraulic tensioner in the timing case cover.
Check seal.
Only replace with a genuine BMW part.



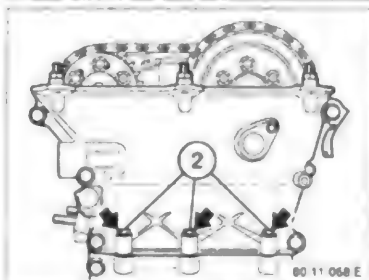
Installation:
Check for correct seating of dowel sleeves (1).
Coat the butt joint corners of the plane between the cylinder head and cylinder head gasket with fluid sealing compound - Hylomar SQ32 Special**.

** Source of Supply: BMW Parts



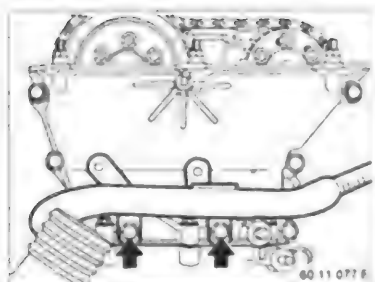
Installation:
Check for correct seating of gaskets.
Press tensioning rail inwards firmly.
Mount timing case cover.
Screw in all bolts.

Bolt Tightening Sequence:
Screw in bolts (1) for securing to cylinder head free of play, but do not tighten!



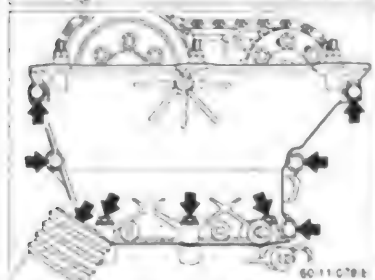
Installation:
Tighten bolts (2) to timing case cover in two steps.
Afterwards tighten bolts (1) in two steps.

11-60/9

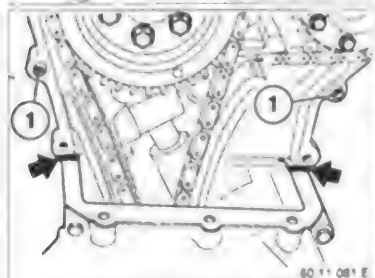


o Removing Upper Timing Case Cover Cylinder Bank 5..8

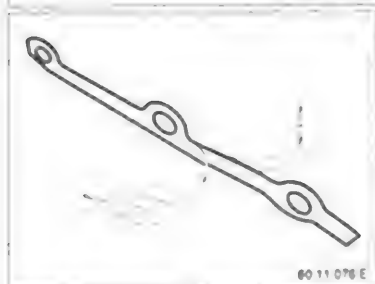
Disconnect battery positive wire at alternator.
Unscrew protective pipe mounting screws.
Place pipe aside.



Unscrew mounting elements on timing case cover.



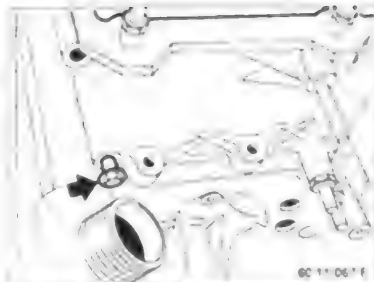
Installation
Check for correct seating of dowel sleeves (1).
Coat the butt joint corners of the plane between the cylinder head and cylinder head gasket with fluid sealing compound - Hylomar SQ32 Special**.



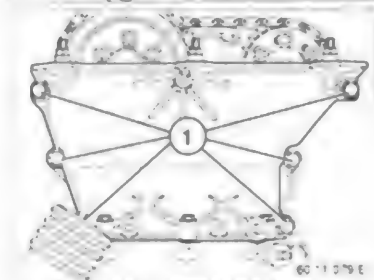
Installation.
Clean sealing surfaces to remove dirt and oil.
Replace gasket.

Important!
Pull off protective sheet.

** Source of Supply: BMW Parts

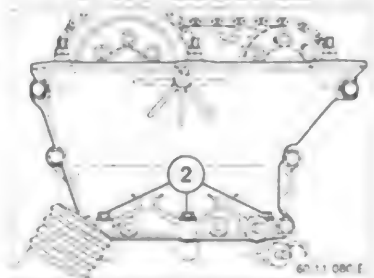


Installation
Check for correct seating of gaskets.
Mount timing case cover with inserted bolt, which cannot be inserted afterwards.



Installation
Screw in all bolts

Bolt Tightening Sequence:
Screw in bolts (1) for securing to cylinder head free of play, but do not tighten!



Installation
Tighten bolts (2) to timing case cover in two steps.
Afterwards tighten bolts (1) in two steps.

** Source of Supply: BMW Parts

11-60/10

o Removing Sprockets

If applicable, unscrew oil pipes for bearing and cam lubrication.

Note

Crank engine in turning direction until peaks of cams on intake and exhaust camshafts of cylinder no. 1 point to each other

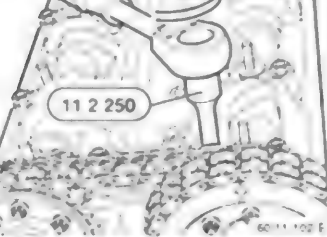
Camshaft Position - Cylinder No. 5

Arrows on sprockets face up in cylinder axis.

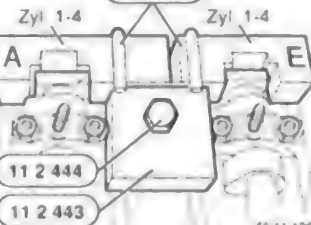
11 2 300



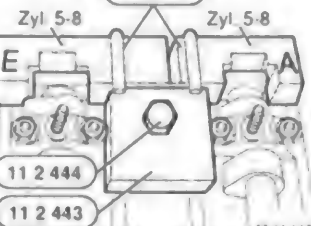
11 2 250



11 2 441



11 2 442



Hold crankshaft in TDC position using Special Tool 11 2 300

Important!

Remove special tool before operating the engine.

Note

Easier installation for later cylinder head removal
Loosen cylinder head bolts from outside to inside in several steps using Special Tool 11 2 250
Remove rear cylinder head bolts from cylinders 4 and 8

Installation

Cylinder head bolt tightening procedures*

Apply Special Tool 11 2 441 on camshafts at cylinder no. 4.

Installation

Mount Special Tool 11 2 441 on exhaust and intake camshafts separately.
Mount Special Tool 11 2 443 and locate above spark plug's tapped bore with help of Special Tool 11 2 444.

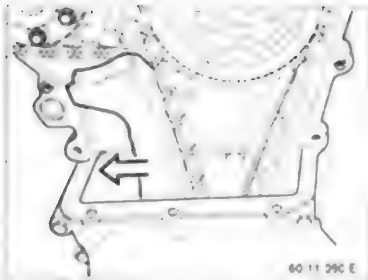
Apply Special Tool 11 2 442 on camshafts at cylinder no. 8.

Installation

Mount Special Tool 11 2 442 on exhaust and intake camshafts separately.
Mount Special Tool 11 2 443 and locate above spark plug's tapped bore with help of Special Tool 11 2 444.

* Refer to Specifications

11-60/11

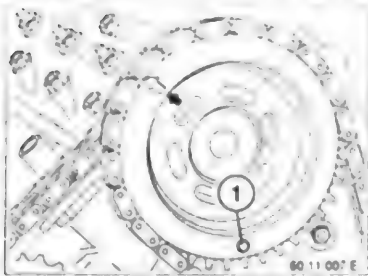


60 11 290 E

Unscrew sprocket bolts from both banks of cylinders.
Remove sprockets.

Important!
Prevent the chain from slipping down.

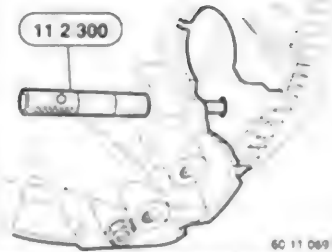
Installation.
Sprockets can only be installed when the timing case cover for cylinder bank 1...4 is removed.



60 11 007 E

Installation.
Sprocket on intake camshaft for cylinder bank 1...4 has a sender pin (1).
Arrow points up; align in middle of slots.

Tightening torque* for sprocket bolts.

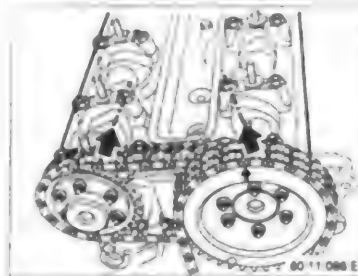


60 11 089 E

Camshaft Adjusting Procedures

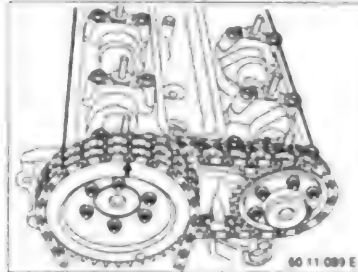
Hold crankshaft in TDC position using Special Tool 11 2 300.

Important!
Remove special tool before operating the engine.



60 11 088 E

Note
Camshaft position - cylinder no. 1



60 11 089 E

Note
Camshaft position - cylinder no. 5

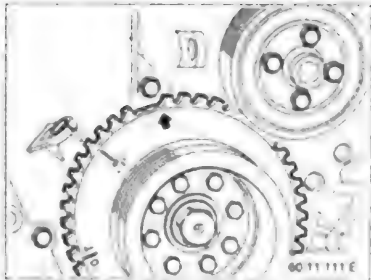


60 11 500 U

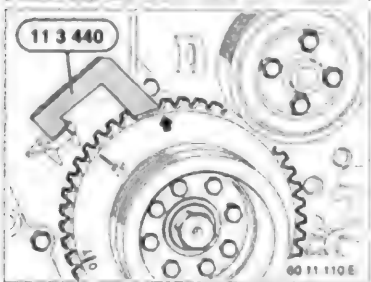
Important!
If the camshaft position has to be corrected so much to have valve movement at cylinders 1 and 4 or 5 and 8, the crankshaft must be turned to approx. 45° before TDC. This will prevent contact between the valves and pistons.

* Refer to Specifications

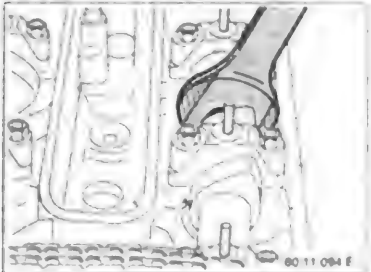
11-60/12



Note:
The vibration damper has a mark for 45° before TDC. In this position the camshafts can be turned without contact between the valves and pistons. If applicable, crank the engine to this position.

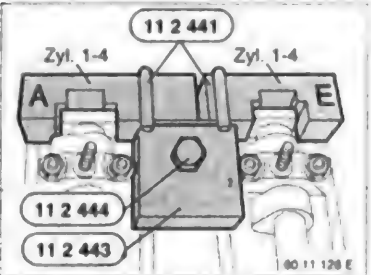


Note:
Vibration Dampers Without Mark for 45° Before TDC:
Apply Special Tool 11 3 440. Crank the engine on the vibration damper opposite its turning direction until the gap of the increment gear fits in Special Tool 11 3 440.



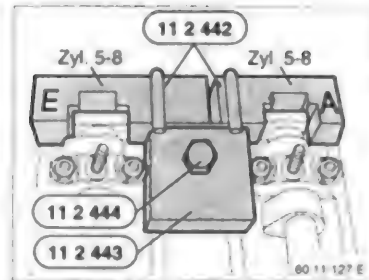
Adjust camshafts on the hexagon using a 27 mm fork wrench.

Important!
Don't damage the cylinder head. Machine the fork wrench accordingly if necessary.



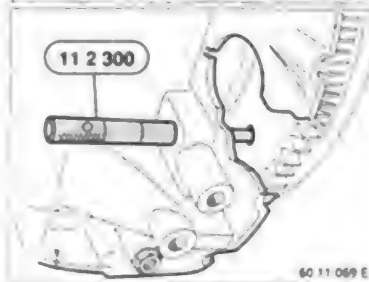
Apply Special Tool 11 2 441 on camshafts at cylinder no. 4.

Installation:
Mount Special Tool 11 2 441 on exhaust and intake camshafts separately. Mount Special Tool 11 2 443 and locate above spark plug's tapped bore with help of Special Tool 11 2 444.



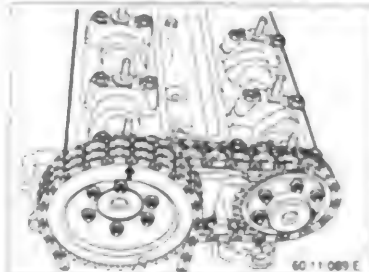
Apply Special Tool 11 2 442 on camshafts at cylinder no. 8.

Installation:
Mount Special Tool 11 2 442 on exhaust and intake camshafts separately. Mount Special Tool 11 2 443 and locate above spark plug's tapped bore with help of Special Tool 11 2 444.

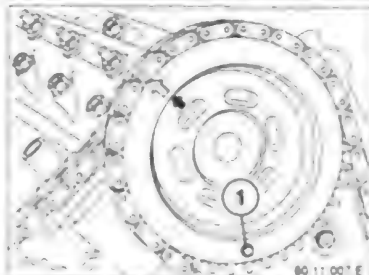


If the engine is cranked to 45° before TDC, crank it in turning direction to TDC position. Hold crankshaft in TDC position using Special Tool 11 2 300.

Important!
Remove special tool before operating the engine.



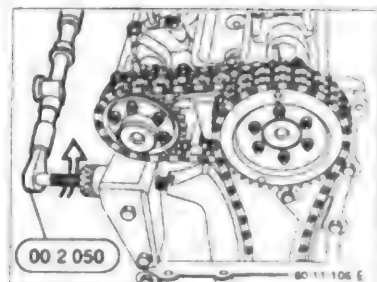
Installation:
First mount sprocket on intake camshaft for cylinder bank 5...8. Arrow points up; align in middle of slots. Install and screw in sprocket bolts to remove play, but "do not tighten".



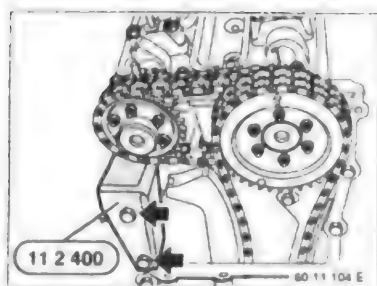
Installation:
Mount sprocket on intake camshaft for cylinder bank 1...4 with sender pin (1). Arrow points up; align in middle of slots. Install and screw in sprocket bolts to remove play, but "do not tighten".

11-60/13

Note:
Since introduction of rubber-coated timing chain sprockets it is absolutely necessary to pull the chain into the tooth root of timing chain sprocket for the control diagram adjustment.



Preload the tensioning rail to 1.3 Nm using Special Tool 11 3 390 by turning the adjusting screw with Special Tool 00 2 050 or a standard torque wrench.



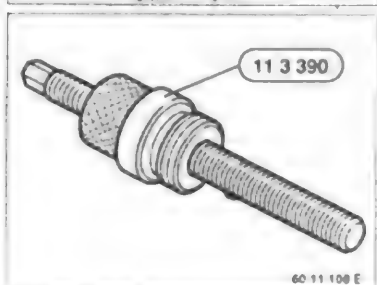
Mount Special Tool 11 2 400 on cylinder head 1...4.

Tighten bolts of all sprockets.

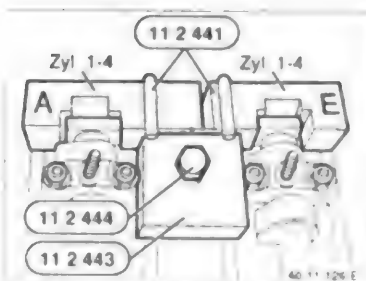
Important!
Pay attention to the tightening sequence for sprockets on camshafts:

- 1 Exhaust camshaft 5...8
- 2 Exhaust camshaft 1...4
- 3 Intake camshaft 5...8
- 4 Intake camshaft 1...4

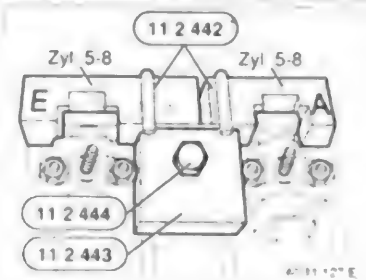
Tightening torque*:



Install Special Tool 11 3 390 in Special Tool 11 2 400



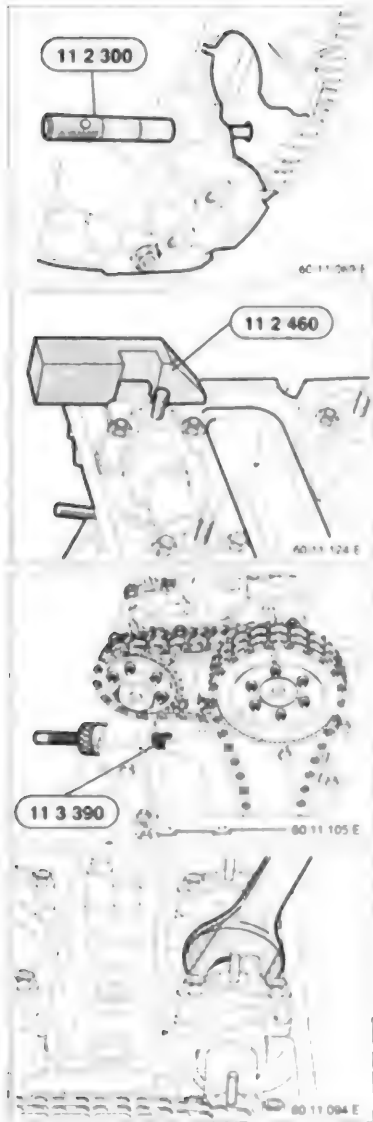
Remove Special Tool 11 2 300 and Special Tool 11 2 441 from cylinder no. 4.



Remove Special Tool 11 2 442 from cylinder no. 8.
Crank engine twice in turning direction

* Refer to Specifications

11-60/14



Hold crankshaft in TDC position using
Special Tool 11 2 300.

Important!
Don't turn the engine back.
Remove special tool before operating the
engine.

Check the camshaft adjustment using
Special Tool 11 2 460.

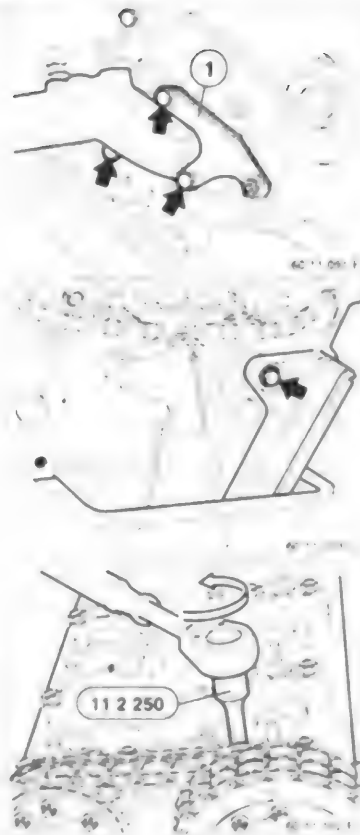
Important!
When checking the camshaft adjustment it
is essential to ensure that the timing chain
is pre-tensioned with Special Tool 11 3 390.

If applicable, unscrew the sprocket of an
incorrectly adjusted camshaft and align the
camshaft on the hexagon using a 27 mm
torq wrench.

Important!
Don't damage the cylinder head.
If necessary, machine the torq wrench
accordingly.

Tightening torque* for sprocket bolts.
Loosen Special Tool 11 3 390.
Remove Special Tool 11 2 400 from the
cylinder head.

* Refer to Specifications



o Removing Cylinder Head
Cylinder Bank 1...4

Unscrew battery positive wire holder (1).
Unscrew water box on back cylinder wall
at left and right sides.

Installation:
Clean the sealing surfaces.
Replace gaskets.
Check seats in water box, replacing if
necessary.

Unscrew sliding rail from cylinder head.

Unscrew cylinder head bolts from outside
to inside using Special Tool 11 2 250.
Lift off cylinder head.

11-60/15

o Removing Cylinder Head Cylinder Bank 5...8

Loosen the headless screw

Installation

Replace only with a genuine BMW part.
The headless screw locates the elbow in the cylinder head.
Tightening torque: 2 to 3 Nm
Unscrew sliding rail from cylinder head

Unscrew sliding rail bolts and oil separator mounting screw

Pry oil separator out of the elbow using a screwdriver

Installation

Check seal in elbow, replacing it if necessary.

Important!

Push the oil separator inwards when removing and installing the cylinder head

Installation

Check for correct seating of the oil return pipe in the oil separator.
Align the return pipe using a screwdriver

Unscrew cylinder head bolts from outside to inside using Special Tool 11 2 250
Loosen oil cylinder head

Installation

Comply with the waiting times for the hydraulic valve tappets when installing the cylinder head.
Refer to "General Information".



11-60/16

o Replacing Cylinder Head Gasket

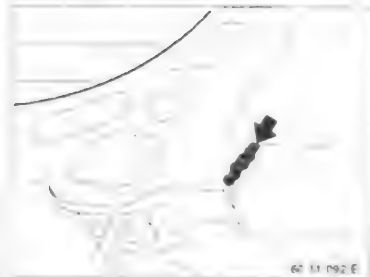
Installation

Clean the sealing surfaces on cylinder head and crankcase; if necessary remove bits of gaskets with gasket remover** and a wood scraper.
Ensure that bits of gaskets do not fall into oil and coolant bores.

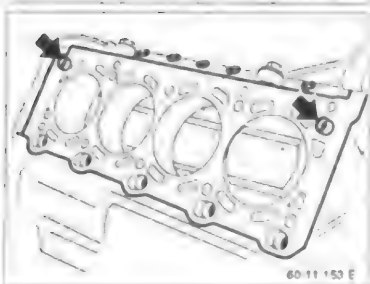
Tapped bores in the crankcase must be free of dirt and oil (danger of cracking the head).

Important!

Maximum 0.3 mm may be machined off of the cylinder head thickness.
A repair gasket is available for compensation of compression.



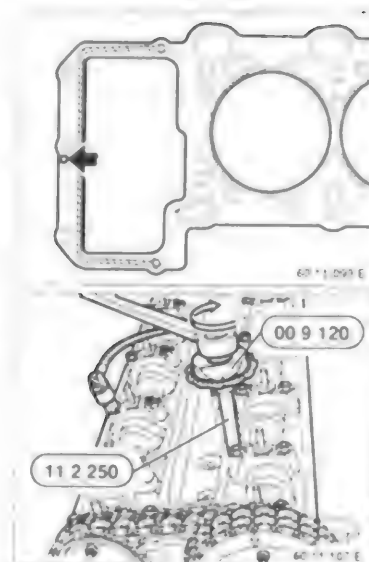
Coat the butt joint between crankcase and timing case cover with Hylomar SQ 32 Special**.



Installation

Check dowel sleeves for damage and correct installed position.
Install new cylinder head gasket.

** Source of Supply: BMW Parts



Installation

Repair gaskets are marked with a hole in the front area.

Installation

Mount the cylinder head together with new bolts (don't remove coat from bolts)!
Keep oil out of the tapped bores (danger of cracking the head).
Use Special Tools 11 2 250 and 11 2 110 or 00 9 120 to tighten bolts to torque angle.

Installation

Install all cylinder head bolts.
Comply with cylinder head bolt tightening procedures*.
Tighten bolts diagonally from the center to the outside in three steps.

* Refer to Specifications

11-60/17

DISASSEMBLING AND ASSEMBLY CYLINDER HEAD

o Setting Up Cylinder Head on Assembly Stand

- 1 Special Tool 00 1 490
- 2 Special Tool 11 0 214
- 3 Special Tool 11 0 213
- 4 Special Tool 11 1 071
- 5 Special Tool 11 1 067

- 6 Special Tool 11 0 192
- 7 Special Tool 11 0 193
- 8 Special Tool 11 0 212
- 9 Special Tool 11 0 244
- 10 Special Tool 11 0 211
- 11 Special Tool 11 1 065

Do not yet mount Special Tool 11 0 211 (tray).

Secure cylinder head to Special Tool 11 1 065 using cylinder head bolts

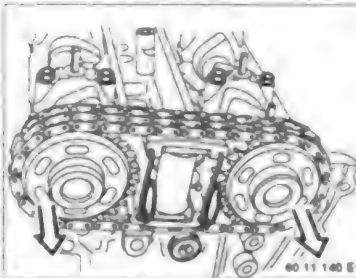
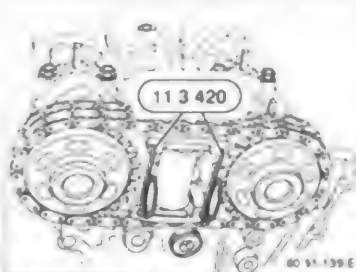
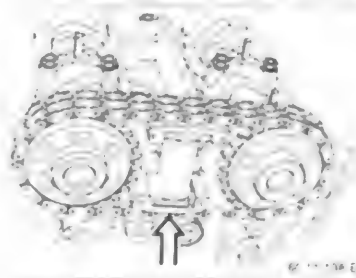
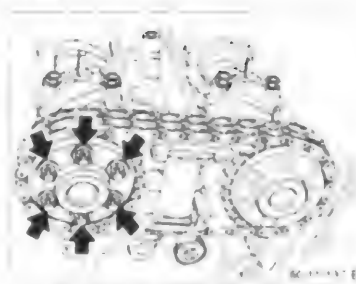
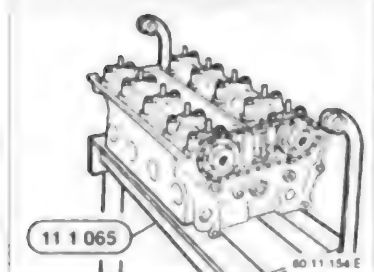
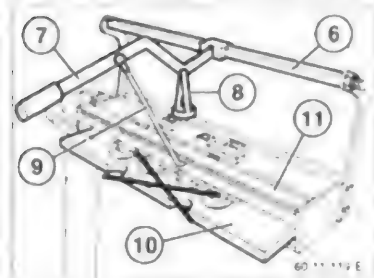
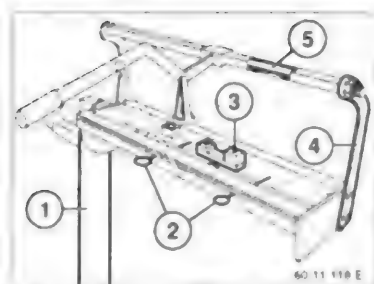
o Removing Camshafts Cylinder Bank 1...4

Unscrew sprocket bolts

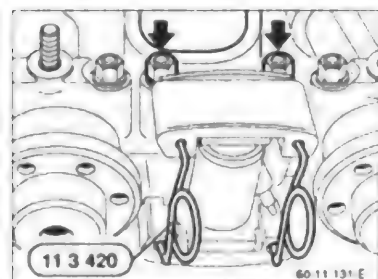
Compress the hydraulic tensioning element to loosen the timing chain

Lock the hydraulic tensioning element using Special Tool 11 3 420.

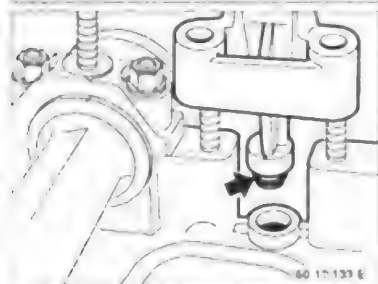
Lift off both sprockets together with the timing chain



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Remove the hydraulic tensioning element for cylinder bank 1...4.

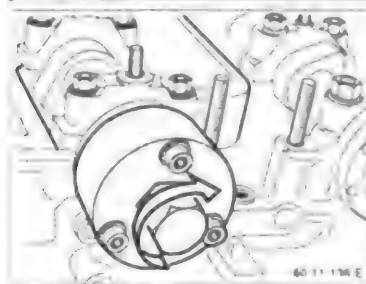


Installation:
Check seal, replacing if necessary.

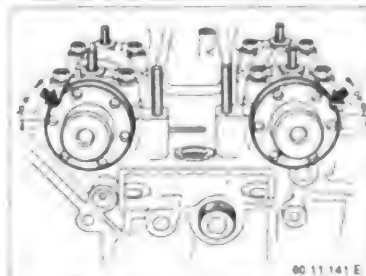


Caution!

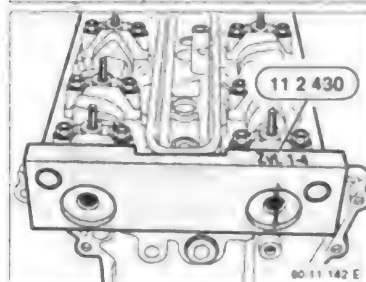
The camshaft could be pre-damaged or broken when installation or removal is incorrect.
In addition, the valves could be bent through contact with the piston crowns when mounting the cylinder head on the crankcase.
Always comply with installing procedures and sequence.



Cylinder Bank 1...4:
Turn camshafts to insertion position.
Turn exhaust and intake camshafts for cylinder bank 1...4 using Special Tool 11 3 430.



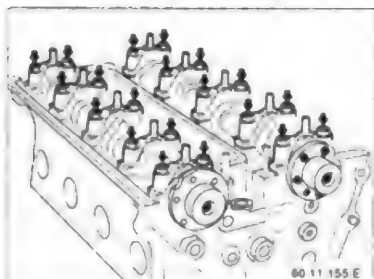
Openings of the camshafts point up at an angle of approx. 30 to 40° from the cylinder head plane.



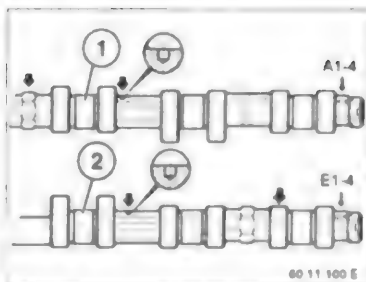
Check the insertion position using Special Tool 11 2 430.

Note
Lettering "cyl. 1-4" on Special Tool 11 2 430 faces up.

11-60/19



Unscrew bearing caps of camshafts for cylinder bank 1...4 uniformly from outside to inside in 1/2-turn steps.



Note

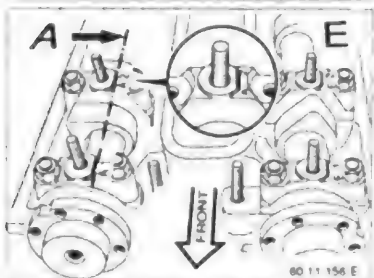
Camshaft identification:

- 1 Exhaust camshaft 1...4
- 2 Intake camshaft 1...4

Marks face up in Ignition TDC.

Additional identification:

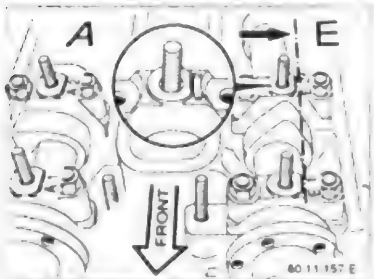
- Exhaust camshaft = hexagon between cylinders 1 and 2.
- Intake camshaft = hexagon between cylinders 3 and 4.



Important!

Don't mix up camshaft bearing caps of cylinder banks 1...4 and 5...8.

Exhaust camshaft bearing caps are marked with A1 through A5 and can be read from the intake side.

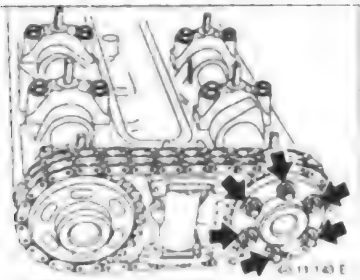


Intake camshaft bearing caps are marked with E1 through E5 and can be read from the intake side.

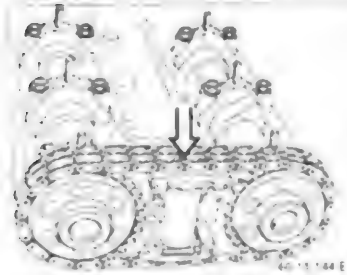
11-60/20

o Removing Camshafts Cylinder Bank 5 - 8

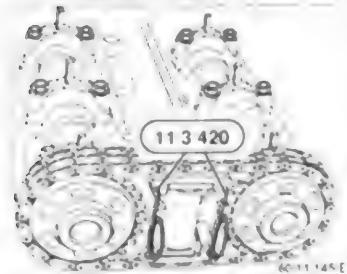
Unscrew sprocket bolts.



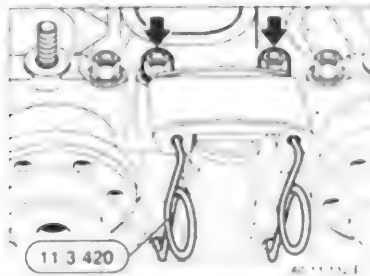
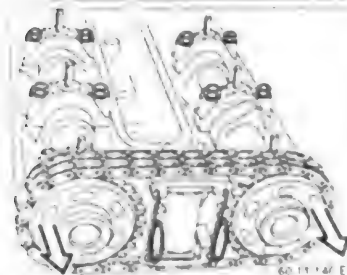
Compress the hydraulic tensioning element
to loosen the timing chain.



Lock the hydraulic tensioning element
using Special Tool 11 3 420

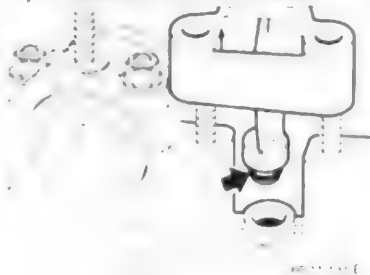


Lift off both sprockets together with the
timing chain



Remove the hydraulic tensioning element
for cylinder bank 5 - 8

Installation
Check seal replacing if necessary



11-60/21



50 11 400 0

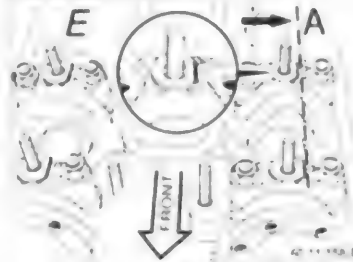
Caution!
The camshaft could be pre-damaged or broken when installation or removal is incorrect.
In addition, the valves could be bent through contact with the piston crowns when mounting the cylinder head on the crankcase.
Always comply with installing procedures and sequence.



60 11 140 1

Unscrew bearing caps of camshafts for cylinder bank 5...8 uniformly from outside to inside in 1/2-turn steps.

Cylinder Bank 5...8:
Turn camshafts to insertion position.
Turn exhaust and intake camshafts for cylinder bank 5...8 using Special Tool 11 2 430.

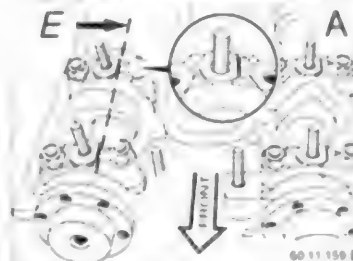


60 11 140 1

Important!
Don't mix up camshaft bearing caps of cylinder banks 1...4 and 5...8.

Exhaust camshaft bearing caps are marked with A1 through A5 and can be read from the intake side.

Openings of the camshafts point down at an angle of approx. 30 to 40° from the cylinder head plane.

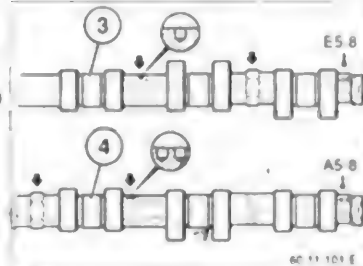


60 11 150 1

Intake camshaft bearing caps are marked with E1 through E5 and can be read from the intake side.

Check the insertion position using Special Tool 11 2 430.

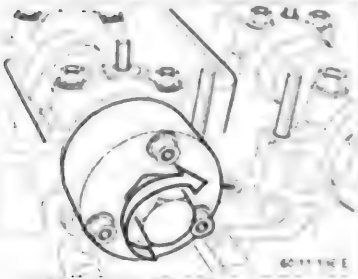
Note:
Lettering "cyl. 5-8" on Special Tool 11 2 430 faces up.



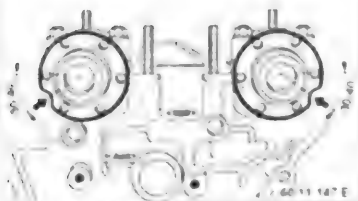
60 11 101 1

Note
Camshaft identification:
3 Exhaust camshaft 5...8
4 Intake camshaft 5...8

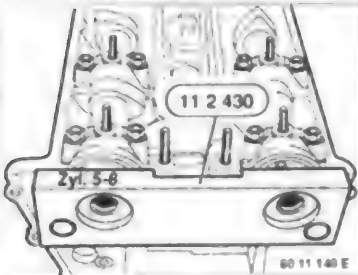
Marks face up in Ignition TDC.
Additional identification:
Intake camshaft = hexagon between cylinders 7 and 8
Exhaust camshaft = hexagon between cylinders 5 and 6.



60 11 140 1

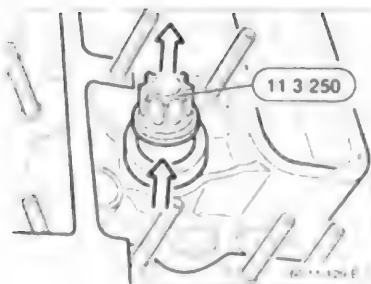


60 11 140 1



60 11 140 1

11-60/22



o Removing Bucket Tappets with Hydr Valve Clearance Compensators

Note

Always only use Special Tool 11 3 250 to remove hydraulic valve clearance compensator bucket tappets.

Note

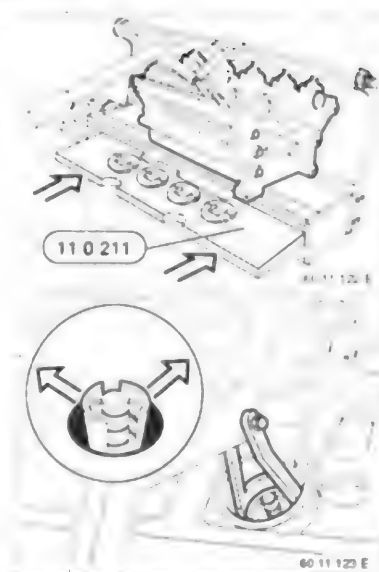
Pay particular attention to damage of the hydraulic valve clearance compensator guides in the cylinder head.

Installation

Inspect bearing surfaces of hydraulic valve clearance compensator bucket tappets for wear and scoring.

Installation

Used hydraulic valve clearance compensator bucket tappets may only be reinstalled in the same tappet bores.



o Removing Intake and Exhaust Valves

Insert Special Tool 11 0 211 (tray) into Special Tool 11 1 065 at bottom. Secure with dowel pins.

Press down valve springs on spring retainer and remove the valve collets. Remove valve springs and spring retainer. Take tray out of assembly stand downward and pull out valve.

Installation

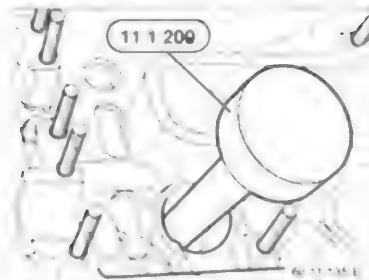
Both valve springs must be replaced, if one inner or outer valve spring is damaged or broken.

Only use inner and outer valve springs of the same make with the same color code.

11-60/23

Installed Sequence.

- 1 Valve
- 2 Valve stem seal
- 3 Outer valve spring retainer
- 4 Inner valve spring retainer
- 5 Outer valve spring
- 6 Inner valve spring
- 7 Upper valve spring retainer
- 8 Valve collets



Installation

Press on valve stem seal as far as stop by hand using Special Tool 11 1 200.
Remove Special Tool 11 1 960.

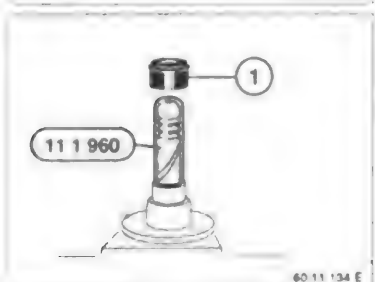
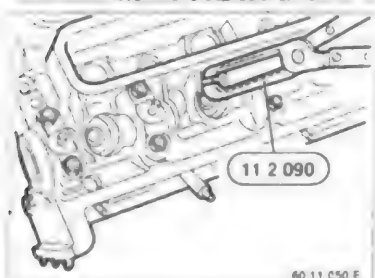
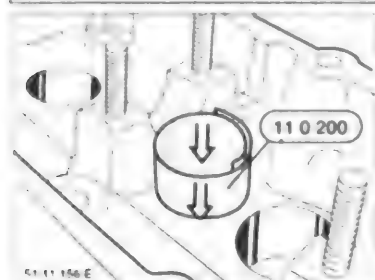
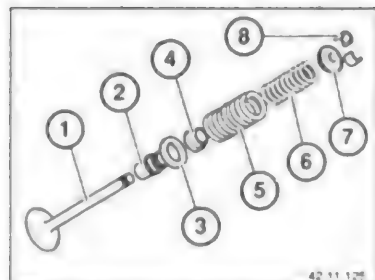
Important!

Bearing surfaces of the hydraulic valve clearance compensator bucket tappets must not be damaged.
Protect them by inserting Special Tool 11 0 200.

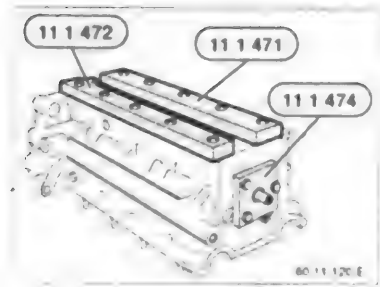
Pull off valve stem seal using Special Tool 11 2 090.

Installation.

Lubricate valve stem with oil and insert valve.
Apply Special Tool 11 1 960.
Lubricate new valve stem seal (1) with oil and install.



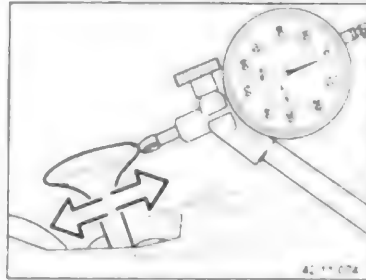
11-60/24



o Checking Cylinder Head for Cracks in Water Test

Check the cylinder head to the following instructions if there is suspicion of leaks in the coolant circuit (cylinder head area)

Plug off the coolant circuit with Special Tool 11 1 471, Special Tool 11 1 472 and Special Tool 11 1 474.



o Machining Valve Guides and Seats

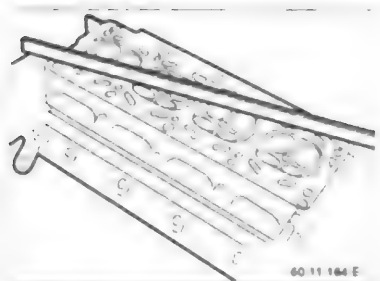
To measure, insert a new valve in such a manner that the valve stem end is flush with the valve guide. Apply dial gage and measure tilt. Max. permissible tilt:

Supply air pressure to cylinder head
Test pressure = 4.5 bar.
Place cylinder head in a water bath and check for cracks.

Note:
Possibly soften the water bath with a detergent.

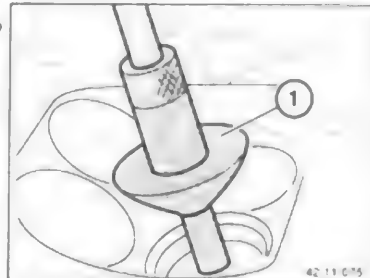
o Reaming Valve Guides

In case of excessive play between the valve stem and valve guide, the valve guide must be reamed out and a repair valve with oversized stem diameter* installed.



o Checking Cylinder Head Sealing Surface

Check levelness of the cylinder head sealing surface with a standard straightedge (steel ruler).
Max. deviation = 0.03 mm



Assemble Special Tool 00 4 200 depending on the stem diameter.
Press guide mushroom (1) against the valve seat and ream out the valve guide dry from the combustion chamber end.
Turn down the reamer once.

Note:
The valve seat must be machined after reaming.

* Refer to Specifications

11-60/25

o Machining Valve Seat

Machine the valve seat to instructions of the tool supplier using Special Tool 00 3 520 or 00 3 580. Dimensions and angles*.

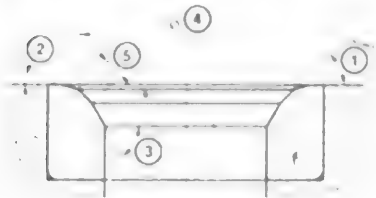
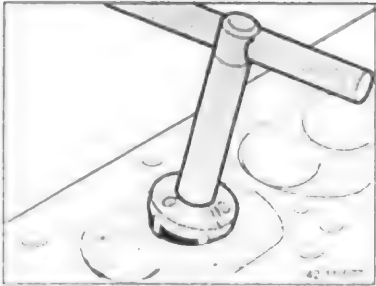
Correction cutter from Neway

After Machining Valve Seat:
Machine valve seat outside and inside diameters to specified size using a correction cutter* in such a manner that the specified valve seat width* is produced.

- 1 Valve seat angle
- 2 Outside dia. correction angle
- 3 Inside dia. correction angle
- 4 Valve seat outside diameter
- 5 Seat width

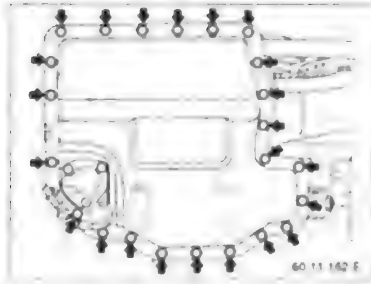
Valve seat dimensions*

* Refer to Specifications



60 11 16 1 E

11-60/26



DISASSEMBLING AND ASSEMBLING CRANKCASE

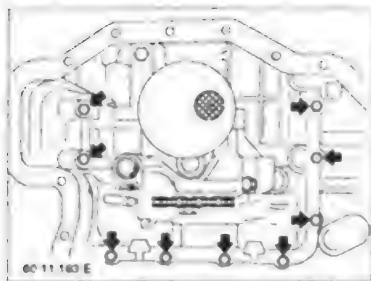
6 Removing Oil Pan Low Section

Unscrew bolts.

Installation
Replace gasket.



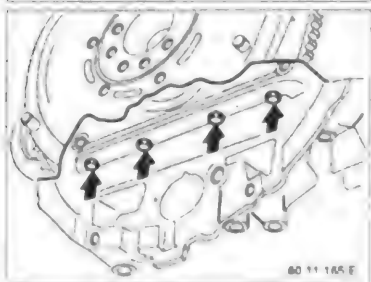
Installation
Clean sealing surfaces and remove bits of gasket.
Coat butt joint edges with fluid sealing compound Hylomar SQ32 Special^{oo}.
Replace gasket.



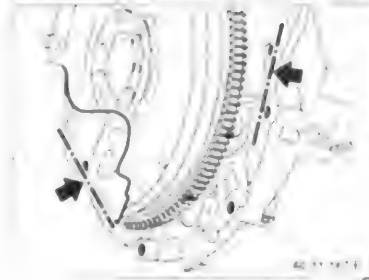
6 Removing Oil Pan Upper Section

Unscrew bolts.

Note
Note bolts inside oil pan.



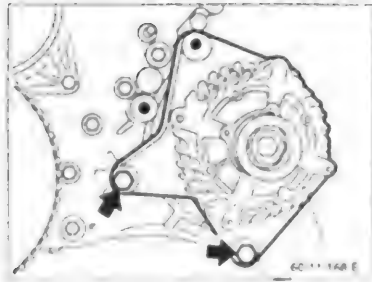
Note
Note bolts for end cover.



Installation
Align the oil pan at the transmission end with the crankcase in order to exclude stress when mounting the transmission later.

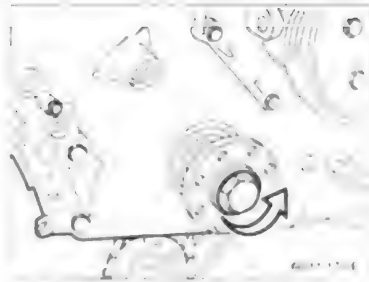
^{oo} Source of Supply: BMW Parts

11-60/27

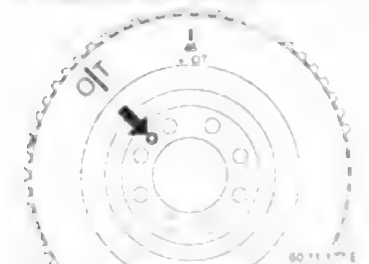


o Removing Alternator

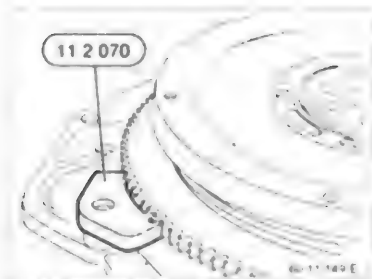
Unscrew bolts.
Refer to Group 12 for electric connections.
Remove alternator



Unscrew central bolt
Remove hub

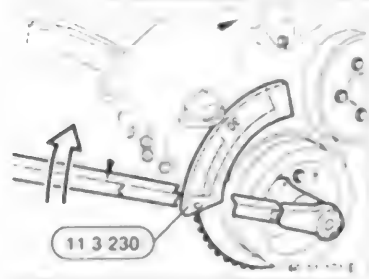


Installation
Align hub with groove for woodruff key
Install central bolt.
Align dowel pin bore in the vibration damper with the dowel pin
Mount vibration damper

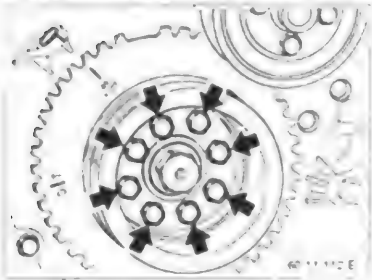


o Removing Vibration Damper

Arrest flywheel using Special Tool
11 2 070.



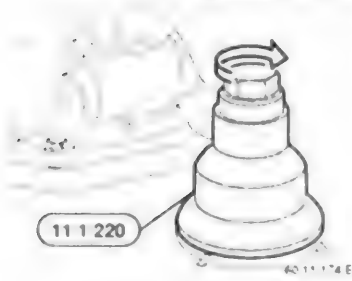
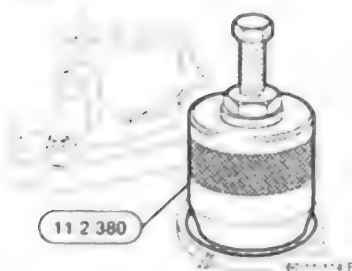
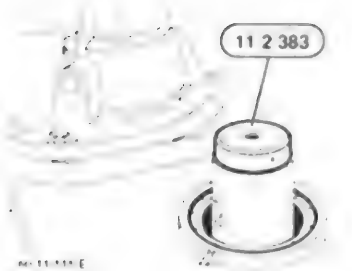
Installation
Mount Special Tool 11 3 230 on the vibration damper.
Tighten the central bolt to specified tightening torque* and torque angle*.



Unscrew vibration damper.

Refer to Specifications

11-60/28

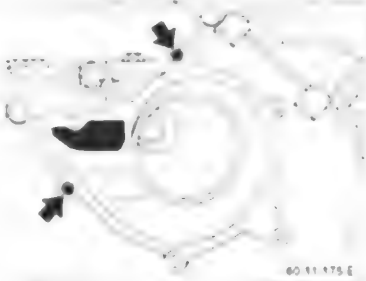
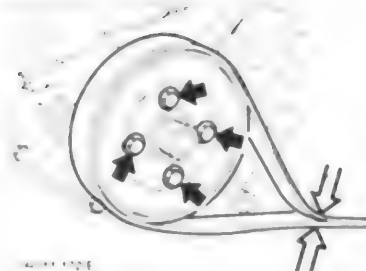


o Replacing Front Radial Oil Seal

Apply Special Tool 11 2 383 on crankshaft

Remove radial oil seal
Apply Special Tool 11 2 380
Screw in special tool far enough that it is securely connected with the radial oil seal
Pull out radial oil seal by screwing in the bolt.

Installation
Lubricate sealing lips of new radial oil seal with oil.
Apply Special Tool 11 1 220 and central bolt flush with the timing case cover



o Removing Water Pump

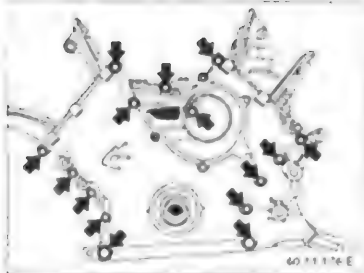
Counterhold the water pump pulley on the ribbed drive belt and unscrew bolts

Unscrew bolts
Remove water pump

Installation
Check for correct seating of dowel sleeves.
Clean sealing surfaces and remove bits of gasket.
Replace gasket

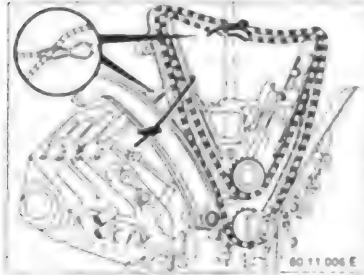
• Refer to Specifications

11-60/29



o Removing Lower Timing Case Cover

Unscrew bolts.

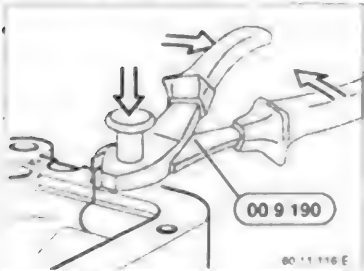


Installation
Secure timing chain and rails with plastic straps.



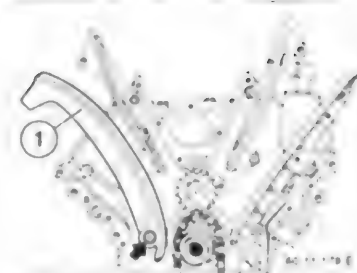
Installation
Check for correct seating of dowel sleeves.
Clean sealing surfaces and remove bits of gasket.
Replace gasket.

Note
Timing case cover gaskets are designed as coated metal gaskets.



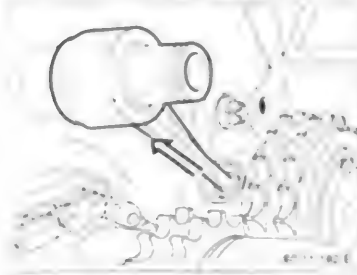
Installation
Cut off protruding ends of gasket using Special Tool 00 9 190.

Important!
Apply the special tool level.
Cut off pieces of gasket must not fall into the engine.



o Removing Timing Chain Guide

Unscrew socket head bolt.
Remove tensioning rail (1).

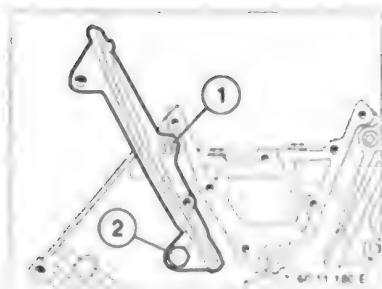


Pull off spacer with oil supply for the tensioning rail.



Installation
Check seal, replacing it if necessary.

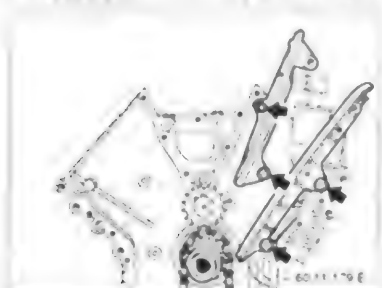
11-60/30



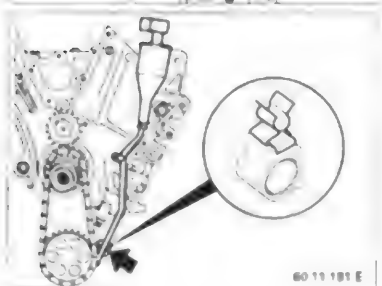
Unscrew sliding rail for cylinder bank 1...4.

Installation

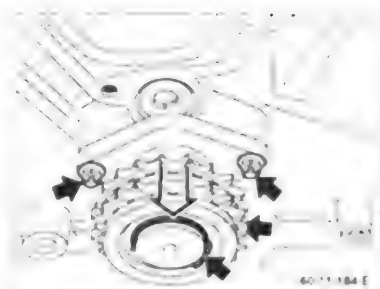
- 1 Socket head bolt
 - 2 Hexagon head bolt
- These bolts must not be mixed up to guarantee clearance with the tensioning rail



Unscrew sliding rails for cylinder bank 5...8



Remove oil separator with return pipe



Unscrew deflection wheel
Remove circlip
Remove deflection wheel together with shim.
Unscrew the three console mounting bolts

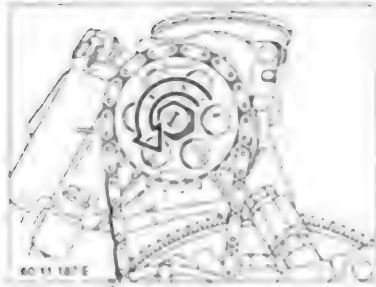


Installation
Check seal, replacing if necessary



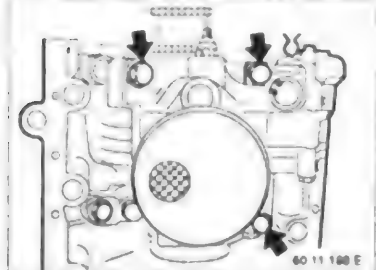
Installation
Check installed position of the deflection wheel.
If the deflection wheel is installed inversed, the chain will be misaligned.

11-60/31

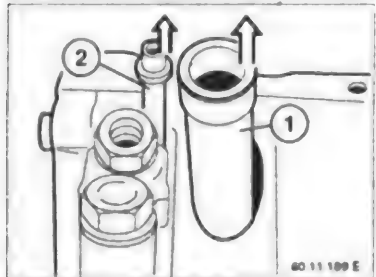


a Removing Oil Pump

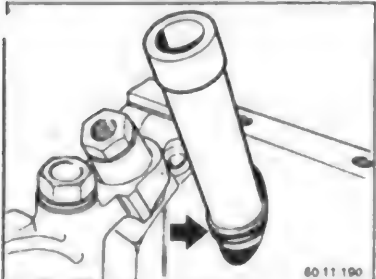
Unscrew sprocket bolt.
Remove sprocket together with chain.



Unscrew oil pump bolts.
Remove oil pump.

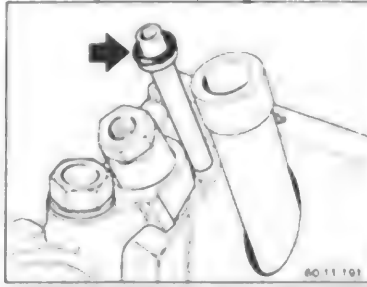


Pull used oil pipe (1) and fresh oil pipe (2)
out of the crankcase.



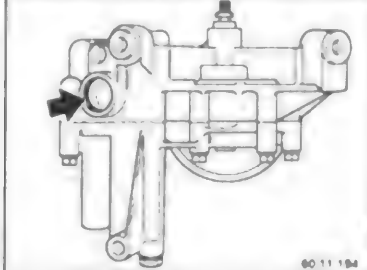
Installation:
Check seal, replacing it if necessary.
Lubricate seal lightly with oil.

Important!
Ensure that seal is not damaged on edge
of crankcase.

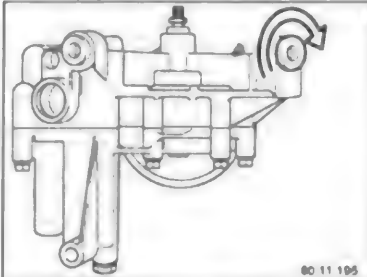


Installation:
Install fresh oil pipe in crankcase.

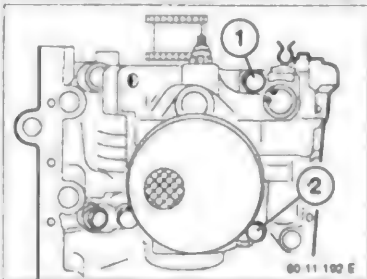
Note:
Check seal, replacing it if necessary.



Installation:
Check seal in oil pump, replacing it if ne-
cessary.

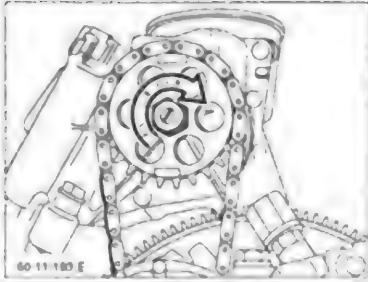


Installation:
Turn back hexagon socket into the oil
pump as far as the stop.

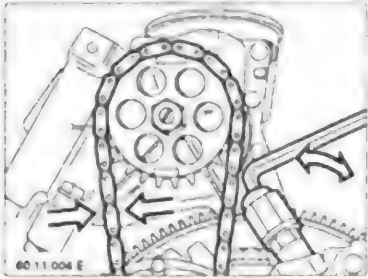


Installation:
Mount oil pump and secure with bolts (1
and 2).

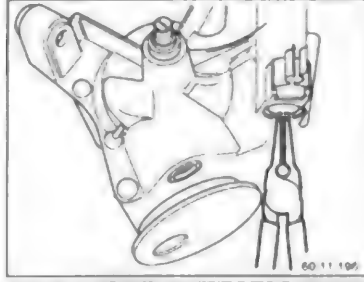
11-60/32



Installation:
Mount sprocket together with timing chain and tighten central nut to specified tightening torque*.



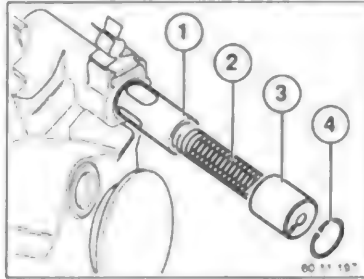
Installation:
Adjust chain deflection (10 ± 2 mm) by turning the hexagon socket in the oil pump. Install and tighten bolt.



o Removing Oil Pressure Regulating Plunger

Press down cylinder using a suitable mandrel.
Remove circlip.

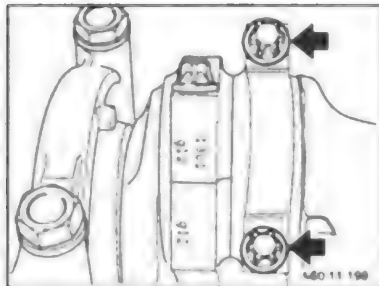
Caution!
High spring pressure.



Installation:
1 = Regulating plunger
2 = Spring
3 = Cylinder
4 = Circlip

* Refer to Specifications

11-60/33

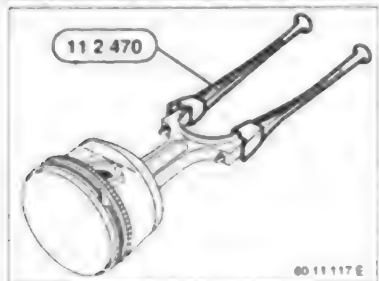


o Removing Connecting Rod with Piston

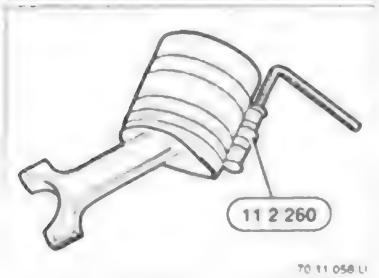
Unscrew conrod bearing cap.
Pull out connecting rod and piston from the cylinder head end.



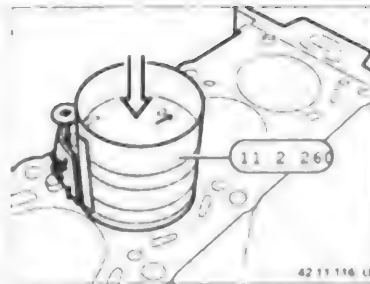
Important!
Reinstall pistons, connecting rods and bearing shells in the same installed position.
Connecting rods and bearing caps are marked with the same pair code and must not be mixed up.



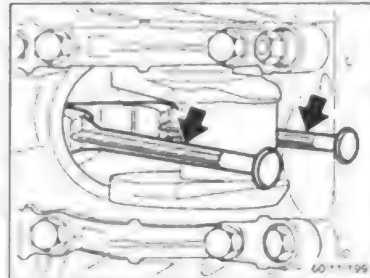
Installation
Apply Special Tool 11 2 470 in the connecting rod.



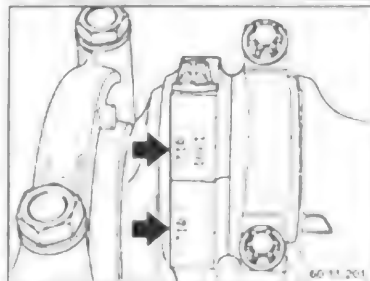
Installation:
Lubricate piston and piston rings lightly with oil.
Align end gaps of piston rings (offset approx. 120°, however, not above the piston pin eye).
Compress piston rings with Special Tool 11 2 260.



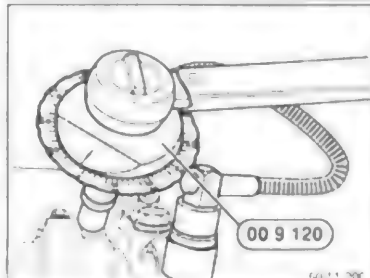
Installation
Insert piston that arrow points to camshaft drive.
The piston ring compressor must bear firmly on the crankcase all around.
Press in piston only with finger pressure; don't knock it in!
Danger of breaking the piston rings.



Installation
Guide crankpin and connecting rod together.



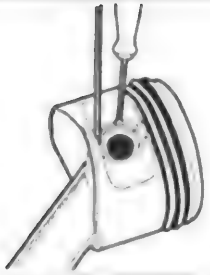
Installation
Lubricate conrod bearing shells with oil.
Mount bearing cap that pair codes match.
Install new conrod bolts.



Installation
Tighten conrod bolts to specified torque* using Special Tool 00 9 120 or 11 2 110.
Pay attention to conrod bolt tightening procedures*.

* Refer to Specifications

11-60/34



70 11 130 11

o Removing Connecting Rod

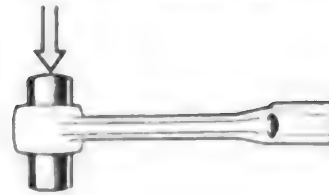
Remove circlip and press out piston pin

Important!

Pistons and piston pins are matched and must not be mixed up.

Installation

Install circlip that its gap is opposite the opening.



70 11 130 11

Checking Piston Pin Bush:

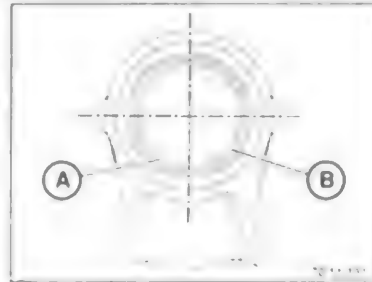
It should be able to push the piston pin through the bush by hand with slight force and without noticeable play.

Replacing Piston Pin Bush:

Press out old bush using a suitable mandrel (23.5 mm dia.)
Press in new bush with bush gap positioned optionally at point A or B.

Installation

Install connecting rod in the piston in such a manner that the installed direction arrow on the piston crown points to the right when the code number is visible.



70 11 130 11

Checking Connecting Rod

Check the connecting rod for deviation in parallelism and displacement

A Testing distance*

B Max. permissible parallel deviation in distance A*

C Max. permissible displacement to each side*



70 11 130 11

Drill oil bore (1)

A 6 mm
B Bore diameter*

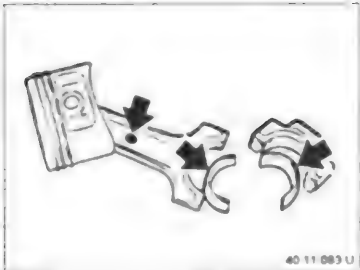
Deburr edges on both sides of bore.
Ream out bush dry with a reamer*.



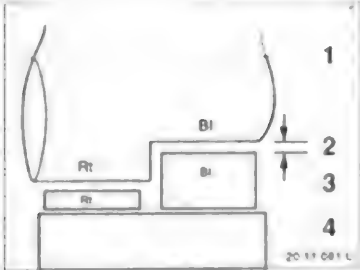
70 11 130 11

* Refer to Specifications

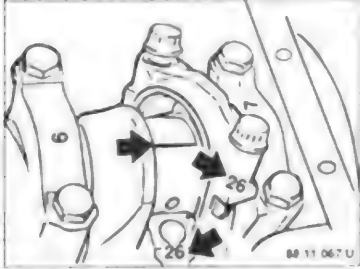
* Refer to Specifications



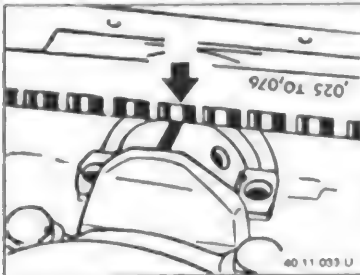
40 11 083 U



20 11 081 L



80 11 067 U



40 11 033 U

c Replacing Conrod Bearing Shells

Select new bearing shells to conform with paint mark on connecting rod.

Important!

Check ground size of the crankshaft - also refer to "Replacing Crankshaft".

Color Code Shaft Diameter Bearing Shell Thickness* Survey

Double Classification Color Codes
Rt = Red
Bl = Blue

- 1 = Crankpin
- 2 = Bearing play
- 3 = Bearing shell thickness
- 4 = Conrod eye

Installation

Checking conrod bearing play.
Only carry out for control purposes.

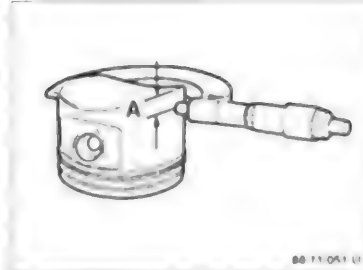
With piston in BDC place Type PG1 Plastigage (Special Tool 00 2 590) on crankshaft wiped clean of oil.
Mount bearing cap and secure with old conrod bolts tightened to specifications.

Important!

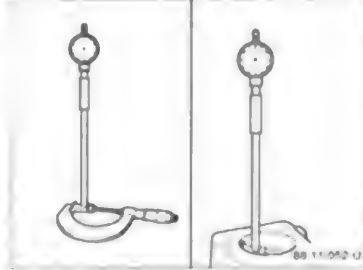
Don't turn the connecting rod or crankshaft.

Remove bearing cap and read bearing play* by measuring width of the flattened Plastigage with help of the supplied scale.
Correct the bearing play by installing new bearing shells or bearing shells with a different paint mark.

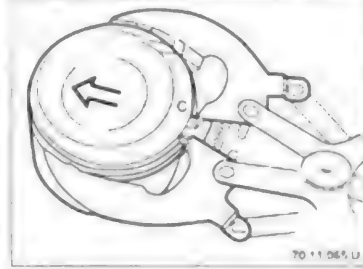
Refer to Specifications



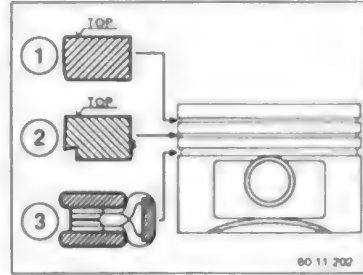
80 11 051 U



80 11 052 U



70 11 065 U



60 11 202

e Replacing Piston

Installation

Measure the piston installed clearance before installing.
Measure the piston diameter at distance A in mm* for M60 3 liter engine or A in mm* for M60 4 liter engine from the bottom edge of the piston and 90° to the piston pin axis using a micrometer.

Set internal caliper to zero on micrometer with the measured piston diameter.
Measure cylinder bore at bottom, middle and top diagonally.

New piston installed clearance*.
Max. permissible total wear clearance*.

e Replacing / Checking Piston Rings

Remove piston rings using a piston ring compressing pliers.

Note

Identification might not be visible on used piston rings.
Lay piston rings aside in correct sequence and position of installation.
New pistons may only be installed together with new piston rings.

Installation

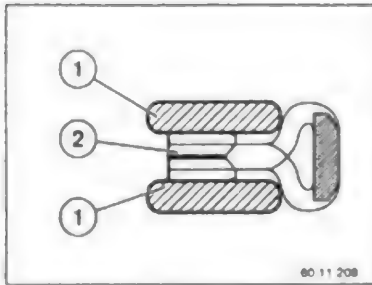
Insert piston rings with "TOP" facing piston crown.

- 1 Plain compression ring
- 2 Stepped taper face ring "Top" (check installed position)
- 3 Three-piece steel band ring

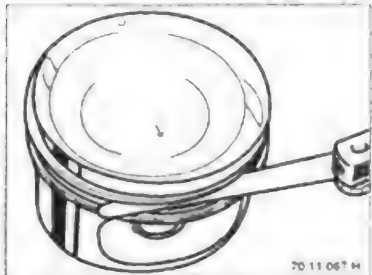
Offset piston ring gaps about 120° to each other, but not above the piston pin eye.

* Refer to Specifications

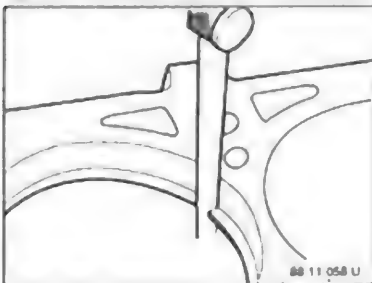
11-60/36



Installation:
The oil scraper ring consists of two steel band rings (1) and one spring ring (2). Install all parts separately. Offset gaps approx. 120°.

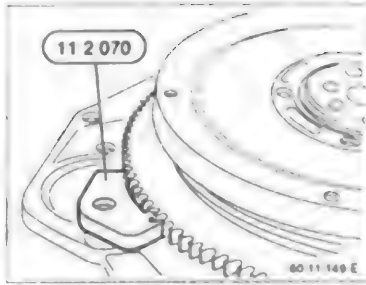


Measure side clearance:
Nominal values*
Max. permissible total wear*

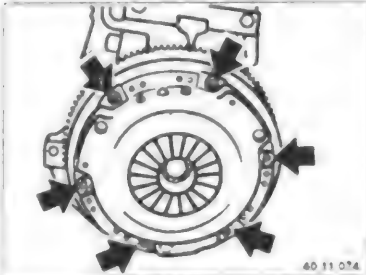


Measure end clearance:
Nominal values*
Max. permissible total wear*

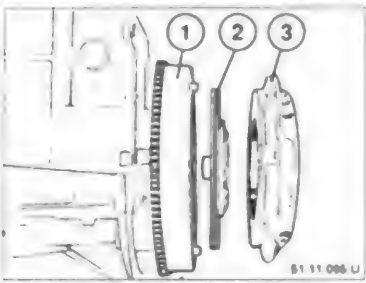
* Refer to Specifications



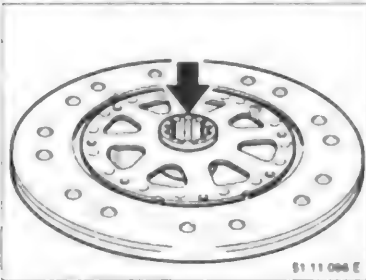
o Removing Clutch / Flywheel
Arrest flywheel using Special Tool 11 2 070.



Unscrew bolts uniformly.
Remove pressure plate and drive plate.
Installation:
Check dowel pins.

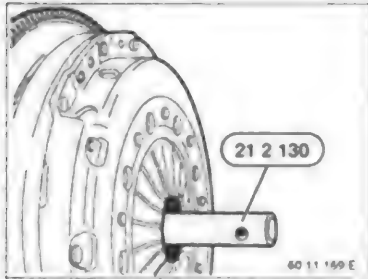


Installation:
1 Flywheel
2 Drive plate
3 Pressure plate

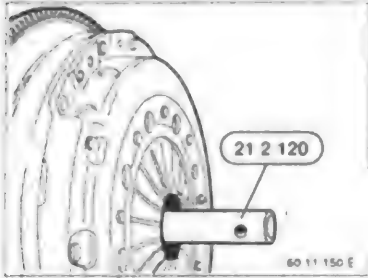


Note:
Flatter side of drive plate (2) faces the transmission.

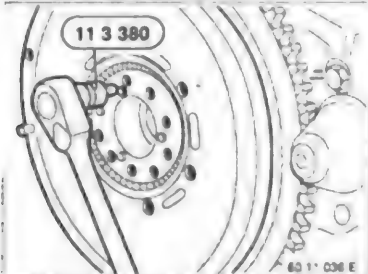
11-60/37



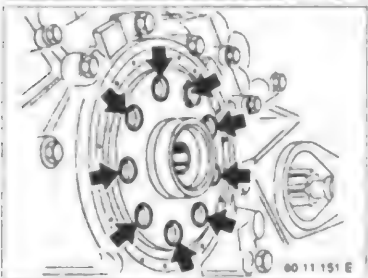
Installation
M60 / 3.0 Liter Engine:
Center drive plate using Special Tool
21 2 130 and tighten bolts in several steps.
Tightening torque*.



Installation
M60 / 4.0 Liter Engine:
Center drive plate using Special Tool
21 2 120 and tighten bolts in several steps.
Tightening torque*.

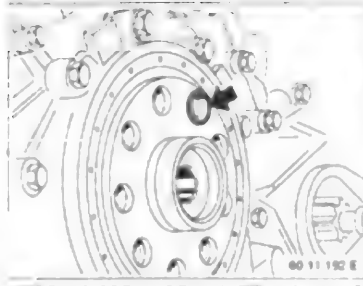


Unscrew double-mass flywheel.
Important!
Always use Special Tool 11 3 380 to un-
screw and tighten a double-mass flywheel.



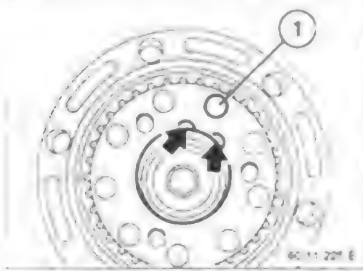
Installation:
Clean tapped bores in crankshaft for
flywheel bolts:

* Refer to Specifications



Installation
The double-mass flywheel has a special
(shorter) dowel sleeve

Important!
Only replace with original BMW parts.



Installation
The location of dowel sleeve (1) in the
double-mass flywheel is indicated by two
notches next to the concerned bolt bore.



Important!
Flywheel bolts are component parts of a
flywheel.
Do not install flywheel bolts with a bolt
cement.
Lubricate threads of bolts lightly with oil.
Always keep to tightening torque.
Excessively tightened flywheel bolts will
cause the special tool to break when re-
moved later.
Tightening torque*.

* Refer to Specifications

11-60/38

o Replacing Pilot Bearing in Crankshaft

Remove pilot bearing using Special Tools 11 2 340 and 11 2 016.

Installation

Insert and drive in new pilot bearing as far as stop using Special Tools 11 2 350 and 00 5 500.

o Removing Rear End Cover

Unscrew bolts and remove cover

Installation

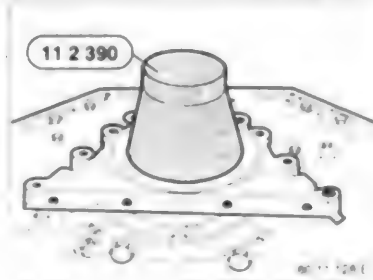
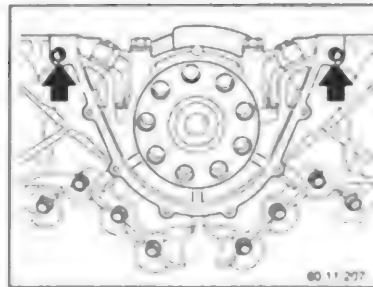
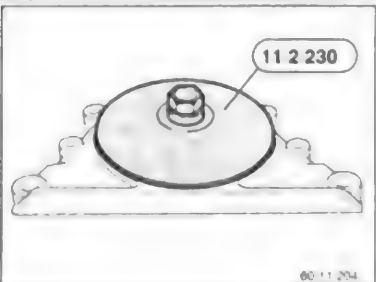
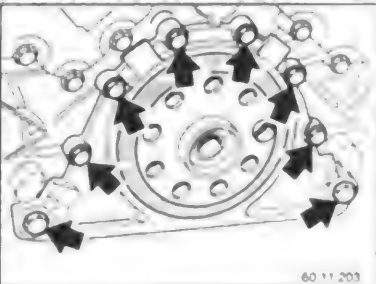
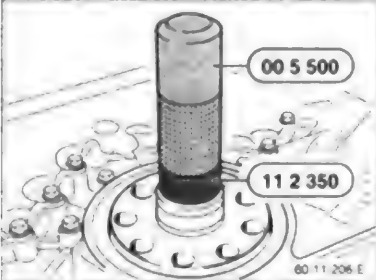
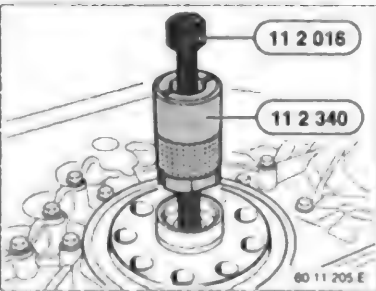
Lift out radial oil seal and drive in new seal using Special Tools 11 2 230 and 00 5 500.

Installation

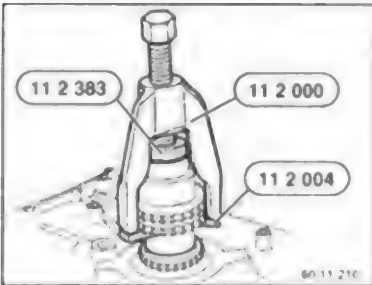
Replace gasket.
Check dowel sleeves for correct fit.

Installation

Apply Special Tool 11 2 390 on crankshaft.
Lubricate sealing lip of radial oil seal with oil.
Install cover and tighten bolts.

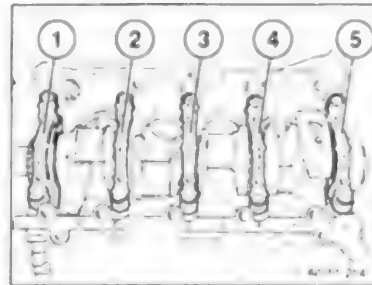


11-60/39



o Removing Crankshaft

Apply Special Tool 11 2 383 on crankshaft.
Pull off sprocket using Special Tools
11 2 000 and 11 2 004.



Remove main bearing caps (1 ... 5).
Lift out crankshaft.

Installation:

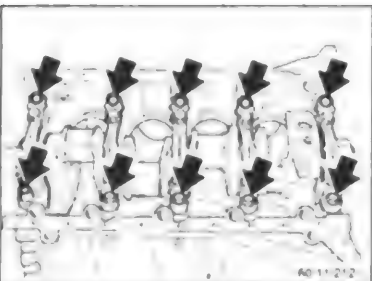
Check key for correct seating.
Heat sprocket to max. 150° C with a hot air
blower or on a hotplate.

Important!

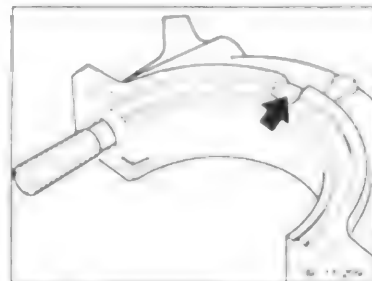
Do not exceed this temperature because of
the rubber coating.

Note

Bearing caps (1 ... 3) are marked with die-
stamped numbers.
Bearing caps (4 and 5) are not marked.

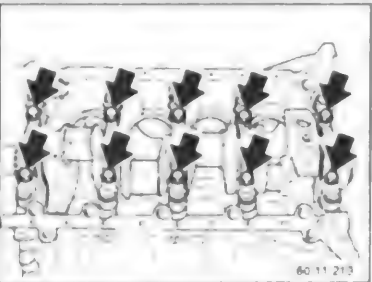


Unscrew inclined bolts and hexagon for oil
pump.



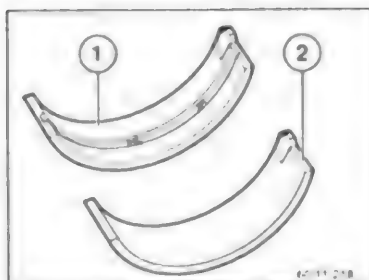
Note

Bearing cap (5) can be recognized on the
openings for thrust washers of the thrust
bearing.

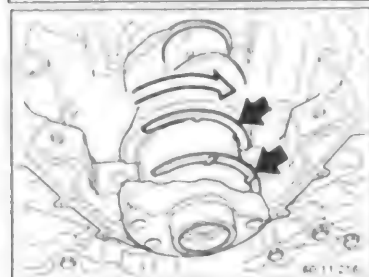


Unscrew main bearing caps.

11-60/40



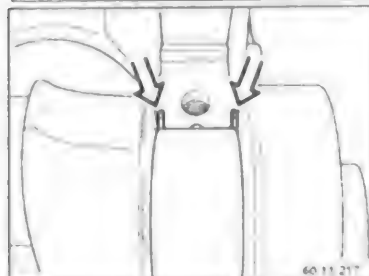
Installation:
Install bearing shells (1) with a lubricating groove in the crankcase.
Install bearing shells (2) without a lubricating groove in the bearing caps.



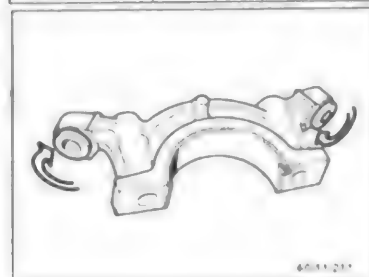
Lubricate bearing shells with oil.
Install crankshaft.

Insert thrust washers for the thrust bearing between the crankshaft and crankcase at bearing no. 5 on both sides.

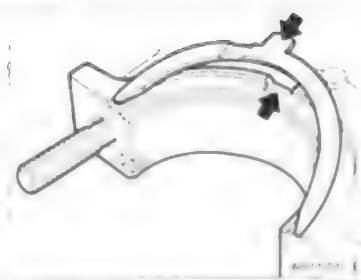
Note the installed direction: lubricating groove faces crankshaft.



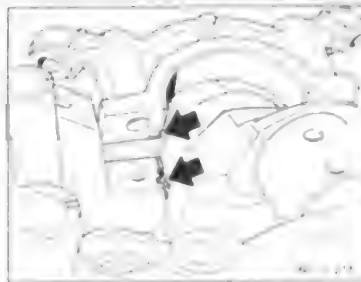
Installation:
Align thrust washers level to bearing surface of the bearing cap.



Installation:
Turn back socket hexagons in bearing cap.



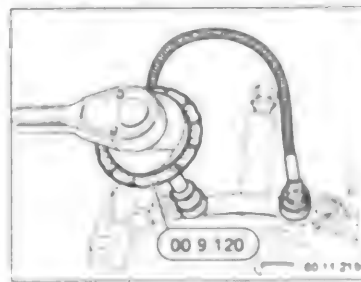
Installation:
Insert thrust washers into grooves of bearing cap no. 5 on both sides.



Installation:
Mount bearing caps (1 - 5) in such a manner that retaining grooves of the bearing shells are all on one side.
Align bearing caps precisely.

Main Bearing Cap Tightening Procedures

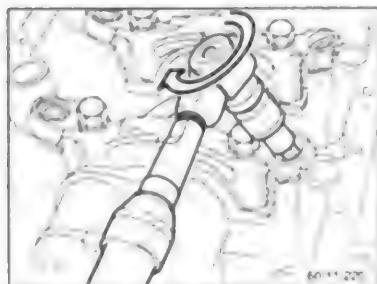
Always replace the main bearing cap shouldered bolts.
Don't wash off bolt coating.
Keep oil out of the tapped bores (danger of cracking the crankcase)!*



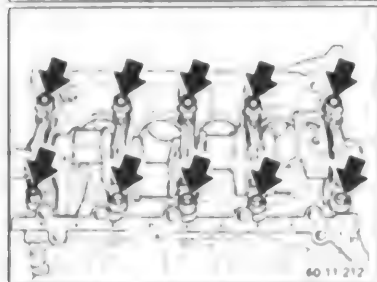
- Step 1: Tighten bolts to specified Nm*
- Step 2: Tighten bolts to specified torque angle* using Special Tool 11 2 110 or 00 9 120.

* Refer to Specifications

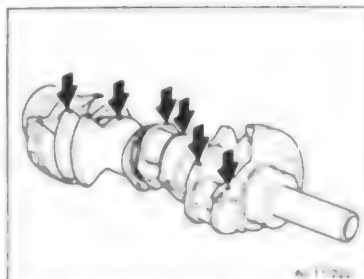
11-60/41



Installation
Move threaded support bush to correct position and tighten to specified torque*

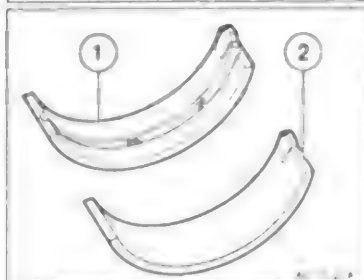


Installation
Install inclined bolts and hexagon bolts for oil pump
Tighten to specified torque*

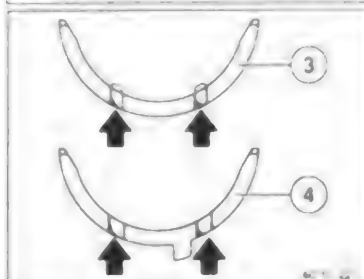


c Replacing Main Bearing Shells

The crankshaft is marked with yellow, green or white paint depending on main bearing journal tolerances

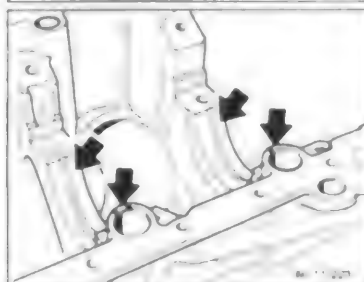


- 1 Bearing shell with lubricating groove (for crankcase)
- 2 Bearing shell without lubricating groove (for bearing caps)



- 3 Thrust washer for thrust bearing (in crankcase)
- 4 Thrust washer for thrust bearing (in bearing cap)

Note
Lubricating groove faces crankshaft

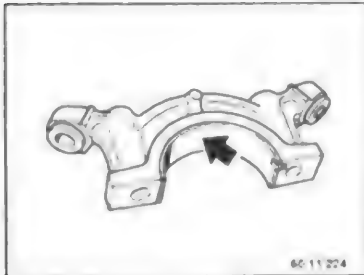


Installation
Bearing shell classification for the crankcase is no longer marked with paint dots, but instead with notches

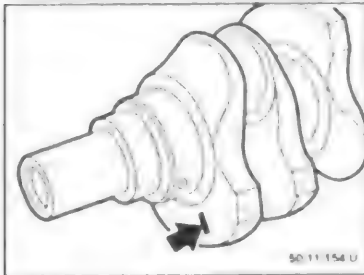
- | | |
|-----------|-----------------------------|
| 1 notch | = yellow bearing shell code |
| 2 notches | = green bearing shell code |
| 3 notches | = white bearing shell code |

* Refer to Specifications

11-60/42



60 11 224



50 11 154 U

Installation

Bearing shell classification for bearing caps is marked on the crankshaft with yellow, green or white paint

Important!

Check ground size* of crankshaft

1 paint stripe	Size 1 (0.25 mm)
2 paint stripes	Size 2 (0.50 mm)
3 paint stripes	Size 3 (0.75 mm)

Note

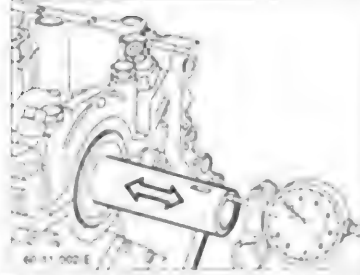
When installing exchange crankshafts, classification does not apply for the allocation of bearing shells in the crankcase. Only install yellow bearing shells in the crankcase.

Check ground size of crankshaft!

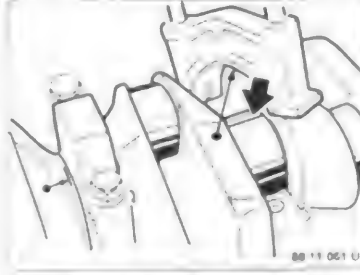
Note

Install bearing shells in bearing caps according to paint mark on the crankshaft (yellow, green or white).

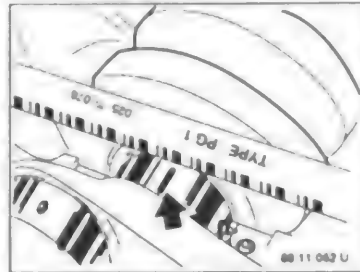
* Refer to Specifications



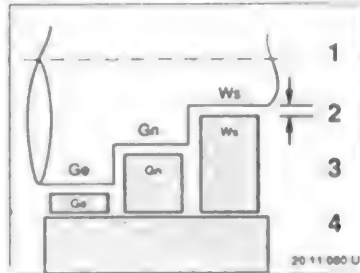
60 11 002 E



60 11 051 U



60 11 042 U



20 11 060 U

Checking Axial Play

If permissible play* is exceeded, check crankshaft and thrust washers and replace if necessary.

Check bearing clearance

Only carry out this step for control purposes.

Install crankshaft

Place Type PG 1 Plastigage (Special Tool 00 2 590) on crankshaft wiped clean of oil and tighten bearing cap bolts as specified. Tightening torque* Don't turn the crankshaft.

Remove bearing cap and read bearing play* by measuring width of the flattened Plastigage with help of the supplied scale. Correct the bearing play by installing new bearing shells or bearing shells with a different paint mark.

Color Code/Shaft Diameter/Bearing Shell Thickness* Survey

Triple Classification Color Codes:

Ge = Yellow
Gn = Green
Ws = White

1 = Crankshaft diameter
2 = Bearing play
3 = Bearing shell thickness
4 = Journal diameter

* Refer to Specifications

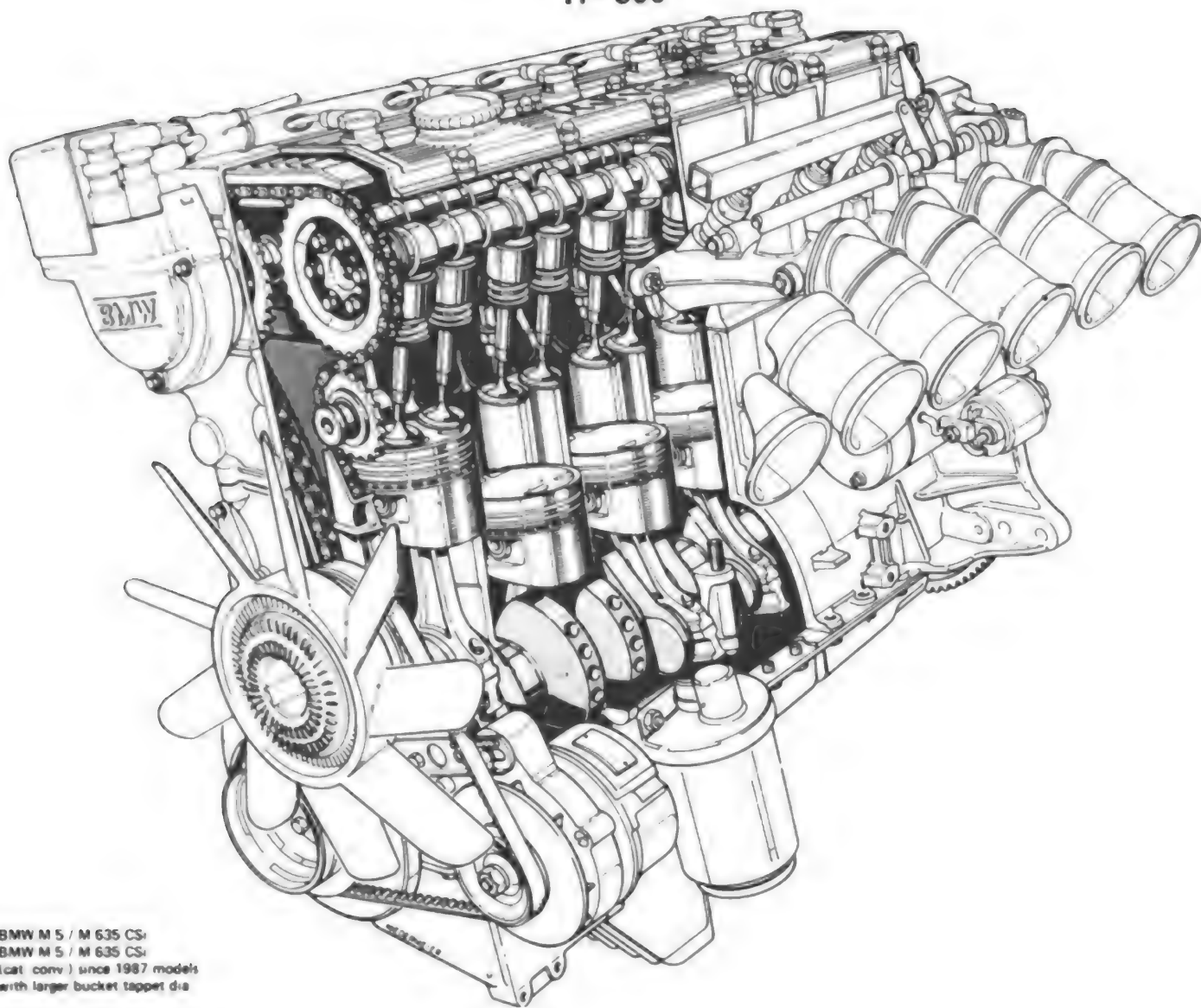
11 Engine M88-3 / S38 Z

M88-3 = 6 Cylinder M-Power Engine

S38 Z = 6 Cylinder M-Power Engine

11 12 000	Cylinder head cover – remove and install	11- 801
101	Cylinder head gasket – replace	11- 801
500	Cylinder head – remove and install (engine removed)	11- 802
595	Valve guide – inspect for wear (valve removed)	11- 804
600	Valve guide – ream (valve removed)	11- 804
607	Valve seats and valves – machine (valves removed)	11- 804
719	Cylinder head sealing surface – grind (cylinder head disassembled) This job is not approved for these engines.	
729	Cylinder head – inspect for cracks in water test (cylinder head disassembled)	11- 805
11 14 105	Radial oil seal in distributor housing – replace	11- 806
110	Lower timing case cover – remove and install/seal	11- 806
141	Radial oil seal in lower timing case cover – replace	11- 808
605	Radial oil seal in clutch end cover	11- 808
11 21 000	Crankshaft – remove and install	11- 809
501	Crankshaft – replace (crankshaft removed)	11- 810
531	Crankshaft main bearing shells – replace (engine disassembled)	11- 810
571	Pilot bearing in crankshaft – replace	11- 811
11 22 000	Flywheel – remove and install	11- 812
541	Starter gear ring – replace	11- 812
11 23 000	Vibration damper with hub – remove and install	11- 813
010	Vibration damper – replace	11- 813
031	Vibration damper hub – replace	11- 813
11 24 521	Connecting rods – replace (pistons removed)	11- 814
571	Conrod bearing shells – replace (disassemble engine)	11- 814
11 25 000	Pistons – remove and install (engine removed)	11- 815
651	Piston rings of one piston – replace	11- 816
11 31 000	Camshaft – remove and install (cylinder head removed)	11- 817
051	Timing chain – replace	11- 820
061	Timing chain sprocket set – replace (timing chain removed)	11- 821
090	Timing chain tensioner piston – remove and install	11- 822
11 34 004	Valve clearance – adjust	11- 823
509	Valves – check for leaks	11- 823
550	Valves – remove and install (cylinder head removed)	11- 824
11 40 000	Engine oil pressure – check	11- 825
11 41 000	Oil pump – remove and install	11- 825
151	Oil pump drive chain – replace	11- 826
11 42 021	Full flow oil filter – replace	11- 827
11 43 101	Oil dipstick guide tube – replace	11- 828
11 51 000	Water pump – remove and install	11- 828
11 52 000	Fan – remove and install	11- 829
020	Fan clutch – replace	11- 829
11 53 000	Coolant thermostat – remove and install	11- 829
000	Coolant thermostat – remove and install (S38 B36)	11- 830
11 62 . . .	Exhaust manifold – remove and install/seal or replace	11- 831

11-800



M 88 3 • BMW M 5 / M 635 CSi
S 38 Z • BMW M 5 / M 635 CSi
(cat conv.) since 1987 models
with larger bucket tappet dia

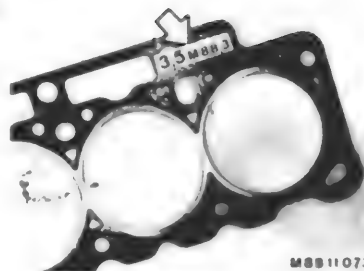
11-801

11 12 000 REMOVING CYLINDER HEAD COVER

Unscrew ignition lead pipe (1):
Disconnect hose (2) and pull out spark
plug connectors.

Unscrew cylinder head cover.

Installation
Check gaskets, replacing if necessary.



11 12 101 REPLACING CYLINDER HEAD GASKET

Remove cylinder head - see 11 12 100.
Clean sealing surfaces on cylinder
head and crankcase thoroughly with a
gasket remover** and hard wood
scraper.
Check levelness with a standard steel
ruler.

Installation

Only use original cylinder head gas-
kets, in which the holes match those
for the coolant system precisely.

Stamped Identification:

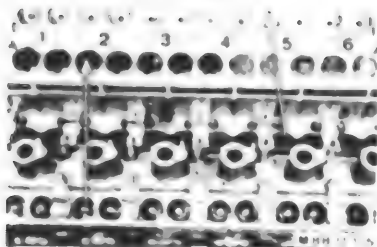
Type	Code	Bore Dia.
M 635 CSI/	3.5 M 88.3	93.4 mm *
M 5		(3.677")

* See Specifications

** Source of Supply: HWB

11-802

11 3 030



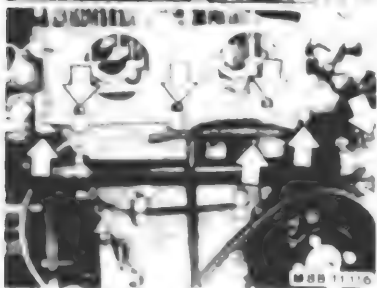
11 12 500 REMOVING AND INSTALLING CYLINDER HEAD - Engine Removed -

Remove camshaft - see 11 31 000
Pull out and place tappets in tray. Special Tool 11 3 030

Reinstall tappets in same position



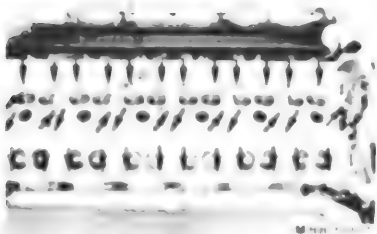
Measuring Tappet Clearance:
Measure tappet diameter with a micrometer



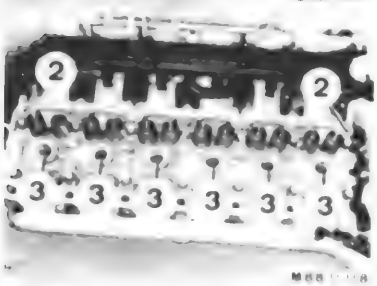
Unscrew pipe
Unscrew bolts



Set internal calipers to zero on the micrometer with the measured tappet diameter.
Measure tappet bore diameter.
Compare the measured tappet clearance with the specified clearance.
Tappet Clearance / Installed Clearance:
0.025 to 0.066 mm (0.0010 to 0.0026")



Unscrew timing case

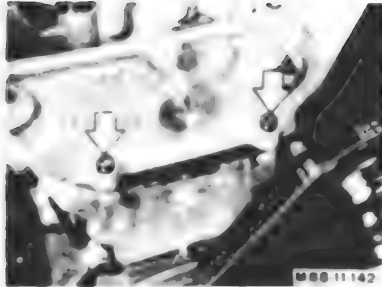


Installation
Replace O-rings (2) in oil bore.
Check O-rings (3), replacing if necessary.
Coat sealing surfaces with Three Bond 1207**.
Tighten bolts uniformly
Tightening torque*.

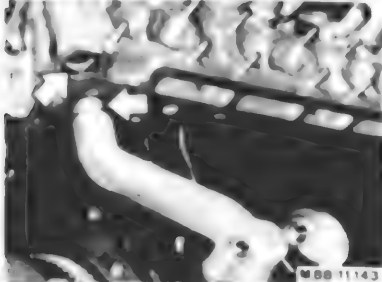
- * See Specifications
- ** Source of Supply: HWB

11-803

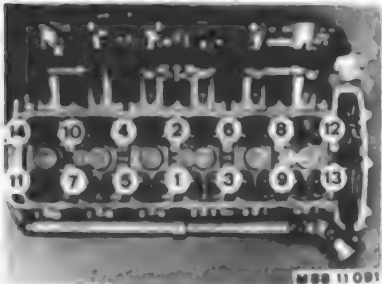
Unscrew bolts.



MSB 11 142



MSB 11 143



MSB 11 091

Unscrew cylinder head bolts in order of 14 through 1 and lift off cylinder head

Installation

Check O-ring, replacing if necessary

Coat pipe with Three Bond 1207**

Clean cavities in crankcase and cylinder head bolts

Lubricate cylinder head bolts with oil

Replace cylinder head gasket - see 11 12 101

Check while mounting cylinder head:

-Pull out timing chain upward

-Press in tensioning rail

-Place timing chain on sprocket for reversing

Tighten bolts in order of 1 through 14 in three steps

Step 1 = 50 +/- 2 Nm (36 +/- 1.5 ft. lbs.)

Step 2 = 80 +/- 2 Nm (58 +/- 1.5 ft. lbs.)

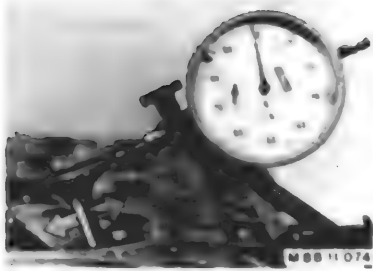
Wait 15 minutes

Step 3 = 100 +/- 2 Nm (72 +/- 1.5 ft. lbs.)

Check and adjust engine idle speed - see 13 00 054.

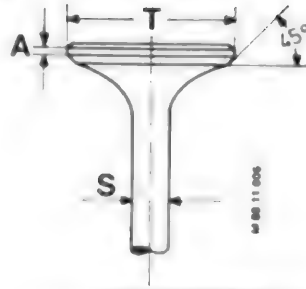
** Source to Supply: HWB

11-804



11 12 595 CHECKING VALVE GUIDE FOR WEAR - Valve Removed -

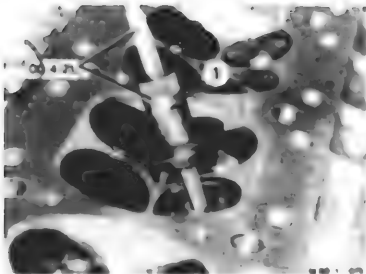
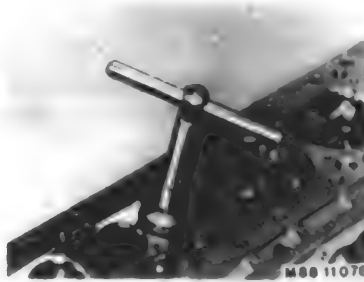
To check wear, install a new valve that the end of the valve stem is flush with the valve guide. Set up dial gage and measure tilt clearance. Max. permissible tilt clearance*



11 12 607 MACHINING VALVE SEATS AND VALVES Valves Removed -

Replace valve, if edge thickness A^* is less than the specified minimum.

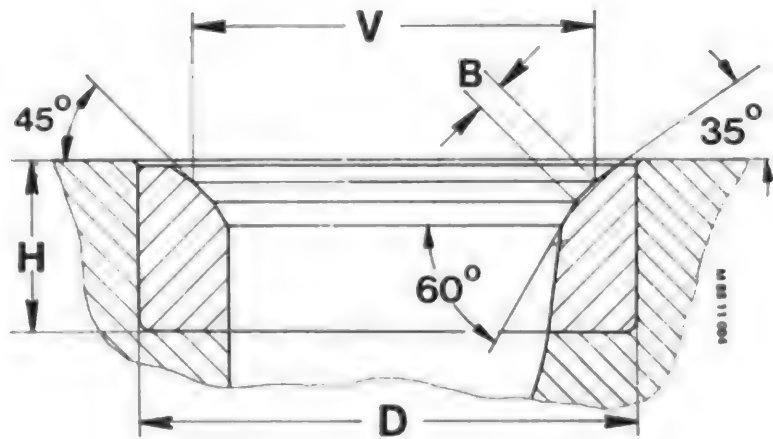
Machine correction angles* to produce valve seat diameter V^* and valve seat width B^* after machining the valve seat angle*. Grind in valves with grinding paste and check valves for leaks - 11 34 509.



11 12 600 REAMING OUT VALVE GUIDE - Valve Removed -

If there is excessive play between the valve guide and valve stem (see 11 12 595), ream out valve guide and install a repair valve with an oversized* stem diameter "S". This also requires machining the valve seat, see 11 12 607.

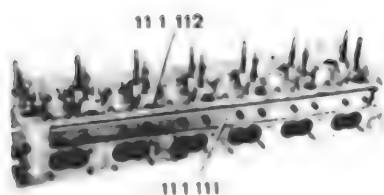
Press guide pad (1) on to valve seat and ream out valve guide starting from the combustion chamber end - turning down reamer once.



* See Specifications

* See Specifications

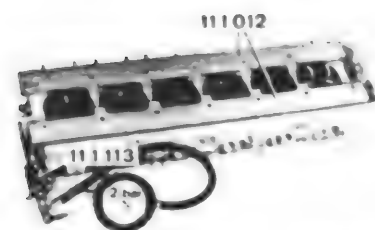
11-805



M88 11093

11 12 729 CHECKING CYLINDER HEAD FOR CRACKS IN WATER TEST - Cylinder Head Disassembled -

Screw on Special Tools 11 1 111 using
Special Tools 11 1 112.



M88 11094

Screw on Special Tools 11 1 012.
Mount Special Tool 11 1 113.
Fill cylinder head with compressed air
(2 bar testing pressure).
Place cylinder head in a water bath and
check for leaks.

Note
Water bath may be relaxed with a detergent
if necessary.

11-806

11 14 105 REPLACING RADIAL OIL SEAL IN DISTRIBUTOR HOUSING

Unscrew ignition lead tube.

Remove distributor cap (1)
Unscrew distributor rotor (2)
Unscrew adapter (3)
Remove cover (4).
Installation:
Check O-ring (5), replacing if necessary.
Tightening torque*

Unscrew distributor housing.
Installation:
Check O-ring, replacing if necessary.

Lift out radial oil seal.
Drive in new radial oil seal with Special Tool
00 5 550
Lubricate sealing lip with oil.

* See Specifications

11 14 110 REMOVING AND INSTALLING/ SEALING LOWER TIMING CASE COVER

Disconnect battery ground lead.
Pull off plug (1) and lift out wires.
Unscrew hose clamp (2).
Unscrew nut (3) and remove air cleaner with
air flow sensor.
Remove vibration damper with hub 11 23 000.

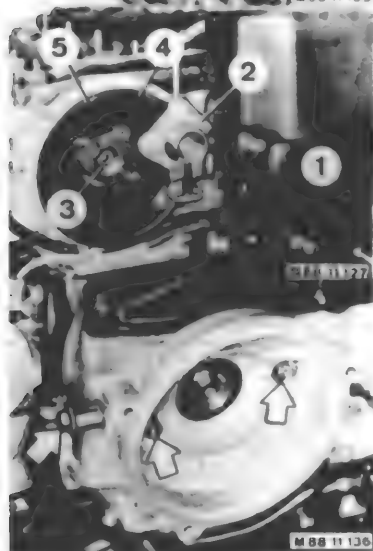
Unscrew pipe.
Remove water pump pulley.

Loosen and swing alternator aside.
Loosen bolt (1).
Unscrew bolt (2).
Unscrew bolts (3) partially.

Unscrew power steering pump and remove
bolts (4).
Installation:
Do not tension console when installing pump
use spacer (5) underneath (see 32 41 131).



M 88 11 135

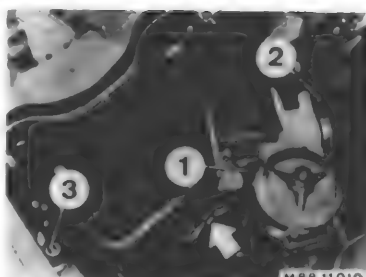


M 88 11 137

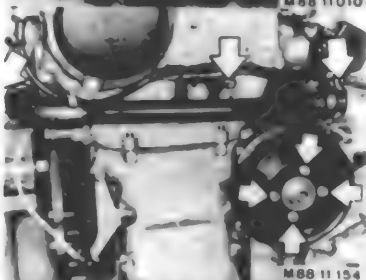
00 5 550



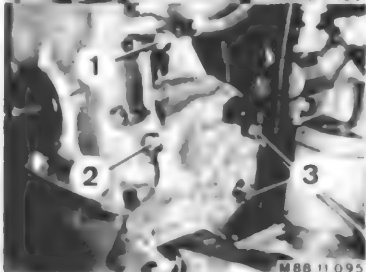
M 88 11 137



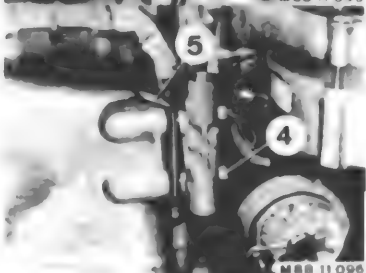
M 88 11 010



M 88 11 154



M 88 11 095

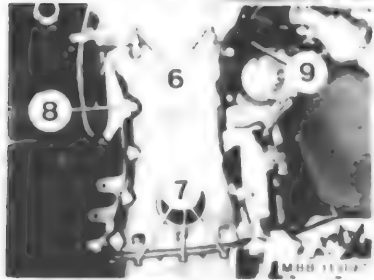


M 88 11 096

11-807



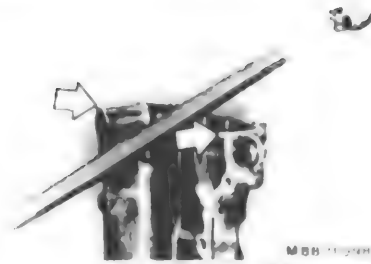
Swing away and tie down console.
Drain engine oil.
Unscrew oil pan bolts.
Installation:
Add engine oil***



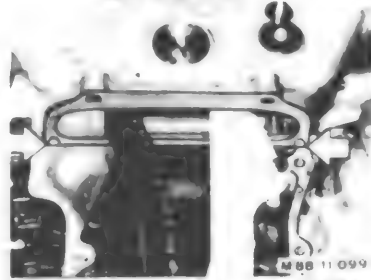
Unscrew bolts (6 and 7).
Loosen remaining oil pan bolts.
Unscrew timing case cover bolts.
Installation:
Mount TDC transmitter (8) and suspension eye (9).
Check length of bolts.
Tighten first bolts (6).



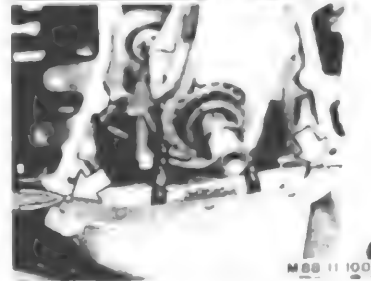
Pry oil pan gasket off of timing case cover carefully with a knife.
If oil pan gasket is damaged, remove oil pan and replace gasket — see 11 13 000.



Remove timing case cover.
Installation:
Break upper edges with a file.
Coat sealing surfaces with Three Bond Silicone 1207**.



Installation:
Replace gaskets, coat with Three Bond Silicone 1207** and cut off ends.
Coat mating surfaces with Three Bond Silicone 1207**.
Guide in cover uniformly.



*** See Service Information of Gr. 00

** Source: HWB

11-808



11 14 141 REPLACING RADIAL OIL SEAL IN TIMING CASE COVER

Remove vibration damper with hub -
11 23 000
Lift out radial oil seal with a screwdriver

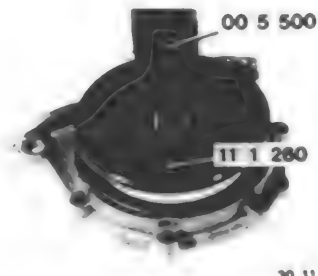


Lubricate sealing lip of radial oil seal with oil
Press in radial oil seal with Special Tools
11 1 273 and 11 1 272



11 14 605 REPLACING RADIAL OIL SEAL IN CLUTCH END COVER - Transmission Removed -

Remove flywheel 11 22 000.
Drain engine oil
Loosen oil pan
Pry off gasket carefully with a knife in area of
end cover/oil pan joint
Remove end cover
Press radial oil seal out of end cover.
Installation
Replace gasket
If oil pan gasket was damaged, remove oil pan
11 13 000
Coat end cover/oil pan joint with a brush on
universal sealing compound / Three Bond
Silicone 1207**
Use Special Tool 11 2 213 to avoid damaging
the radial oil seal
Add engine oil***



Press in radial oil seal with Special Tools
11 1 260 and 00 5 500
Install new radial oil seal with about 1 to 2 mm
(0.039 to 0.079") offset toward the inside in
contradiction to the standard radial oil seal,
which had been installed flush.
Lubricate sealing lip with oil.

** Source: HWB
*** See Service Information of Gr 00

11-809

11 21 000 REMOVING AND INSTALLING CRANKSHAFT

Remove engine 11 00 050
First unscrew rear and then front exhaust
manifolds.
Installation:
Replace gaskets.
Tightening torque*

Unscrew right engine bracket and mount engine
on Special Tool 00 1 490 with help of Special
Tool 11 0 120
Installation:
Tightening torque*

Remove clutch disc 21 21 000
Remove cylinder head 11 12 100
Remove timing chain 11 31 051
Remove oil pump 11 41 000
Check axial play* before removing crankshaft
Check/replace thrust bearing, if maximum
permissible play is exceeded.

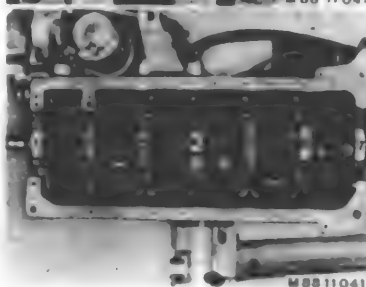
Remove flywheel 11 22 000.
Unscrew end cover.
Installation:
Replace gasket.
Use Special Tool 11 2 213 to avoid damaging
radial oil seal.
Cut off gasket on oil pan sealing surface.

* See Specifications



Unscrew conrod bearing caps.

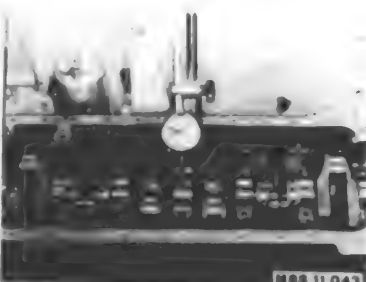
Installation:
Replace conrod bearings and check conrod
bearing play, see 11 24 571



Unscrew crankshaft bearing caps and lift out
crankshaft

Installation:
Bearing cap no. 1 is on sprocket end.
Mount oil pump console together with thrust
bearing cap (4).
Install bearing shells and check bearing play,
see 11 21 531.

Installation:
Check axial play with crankshaft installed –
unscrew thrust bearing cap no. 4 again.
Center thrust bearing by applying knocks on
rear and front ends of crankshaft with a plastic
hammer.
Tighten thrust bearing cap as specified.
Check axial play*
If crankcase had to be replaced, clean oil and
water bores or passages again thoroughly to
remove cast sand.



Check runout deviation:
Insert bearing shells 1 and 7.
Apply dial gauge on center bearing and measure
runout* while turning crankshaft.

* See Specifications

11-810

11 21 501 REPLACING CRANKSHAFT - Crankshaft Removed -

Note

A replacement crankshaft is supplied complete with corresponding bearing shells for main and conrod bearings.

Crankshaft Identification:

Engine	Stroke (mm)	Code
M 88/3	84 (3.307")	M
S 38 Z	84 (3.307")	M
S 38 B 36	86 (3.386")	D

The crankshaft is surface treated and may only be reground in the factory. Reground crankshafts are marked with stripes of paint.

Conrod Bearing Journal (A)

(not applicable for S 38 B 36):

1 paint stripe	Size 1 *
2 paint stripes	Size 2 *

Main Bearing Journal (B) (conrod and main bearings for S 38 B 36):

1 paint stripe	Size 1 *
2 paint stripes	Size 2 *
3 paint stripes	Size 3 *

Transferring Sprocket:

Lift out woodruff key (1).
Pull off sprocket with Special Tool 11 2 000.

Installation

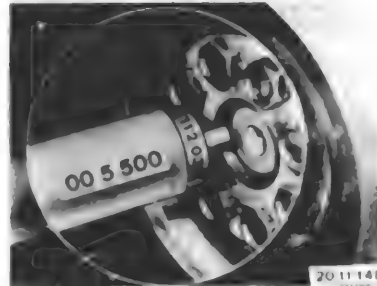
Heat sprocket to max. 200° C (390° F) for installation.

Installing Pilot Bearing for Transmission Main Shaft:

Installed Order:

Ball bearing (1), cover (2), felt ring (3) and capsule (4).
Insert cover (2) with the embossment facing out.

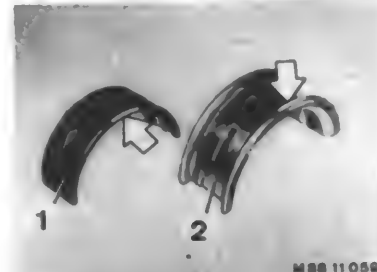
* See Specifications



Fill bore in the crankshaft with approx. 1 gram (0.035 oz.) of lubricating grease. Drive in pilot bearing with Special Tools 11 2 030 and 00 5 500.



The crankshaft is marked with red or blue paint depending on the main bearing journal tolerances.



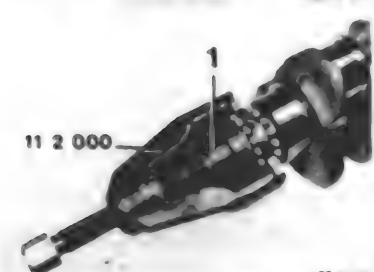
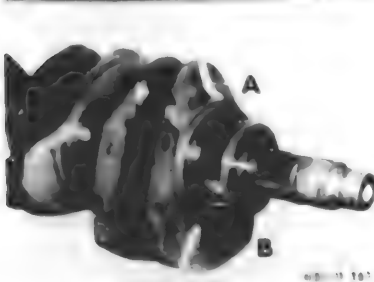
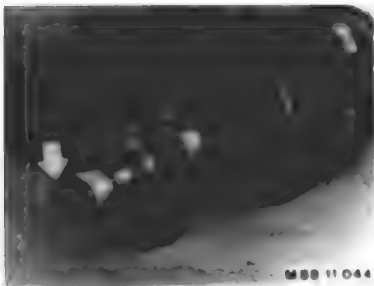
1 = Bearing shell 1-2-3-5-6-7
2 = Bearing shell 4 (pilot bearing)

The color code mark is located on the side of a bearing shell.

Check the ground size of main bearing journals!



Installing Instructions:
Install only "red" bearing shells in the crankcase (regardless of the old color code marks on the crankcase). Install "red" or "blue" bearing shells in the bearing caps depending on the color code of the crankshaft bearing journals.



11-810a

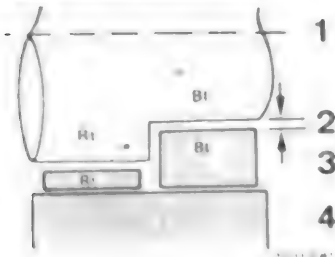


Install crankshaft:
Place Type PG-1 Plastigage on crankshaft wiped clean of oil and tighten bearing caps with correct torque*. Do not turn the crankshaft.

Source of Supply for Plastigage:
CARTOOL
Alfred-Brehm-Str. 5
D-8070 Ingolstadt



Remove bearing caps.
Read bearing play* by measuring the width of the flattened Plastigage with help of the supplied scale.
Correct the bearing play by installing new bearing shells, bearing shells of a different machined size or with a different color code.



Survey of Color Code/Shaft Diameter/Bearing Shell Thickness*

Double Classification Color Codes:
Rt = red
Bl = blue

- 1 Crankshaft diameter
- 2 Bearing play
- 3 Bearing shell thickness
- 4 Console diameter

Replacing Conrod Bearing Shells:
Red or blue conrod bearing shells are installed standard depending on the color code mark on the connecting rod for a pertinent ground size of the crankshaft.

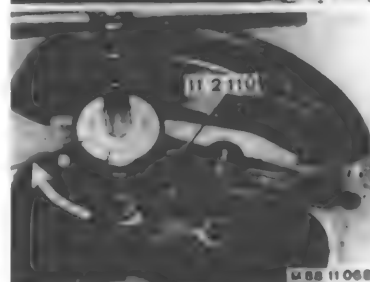
Install only **yellow** bearing shells of the pertinent ground size supplied with a replacement crankshaft.

* See Specifications



Place Type PG-1 Plastigage on conrod bearing journals wiped clean of oil in BDC position.
Mount conrod caps with pair numbers and bearing shell grooves on the exhaust manifold side.

Source of Supply for Plastigage:
CARTOOL
Alfred-Brehm-Str. 5
D-8070 Ingolstadt



Tighten bolts (use old conrod bolts).
Do not turn the crankshaft.
Remove conrod bearing caps.

Conrod Bolt Tightening Torque:
Step 1 10 Nm (7 ft. lbs.)
Step 2 30 Nm (22 ft. lbs.)
Step 3 60 ± 2° torque angle

Conrod bearing play = 0.024 to 0.064 mm (0.0009 to 0.0025").

Installation:
Use new conrod bolts for final installation.

Check conrod bearing play by measuring the width of the flattened Plastigage with help of the supplied scale.



11-810b

11 21 531 REPLACING CRANKSHAFT MAIN BEARING SHELLS - Engine Disassembled -

The crankshaft is marked with red or blue paint depending on the main bearing journal tolerances.

- 1 = Bearing shell 1-2-3-5-6-7
2 = Bearing shell 4 (pilot bearing)

The color code mark is located on the side of a bearing shell.

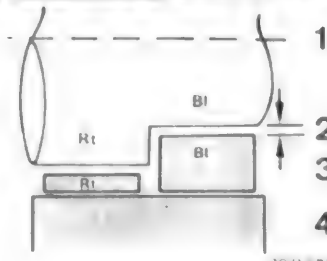
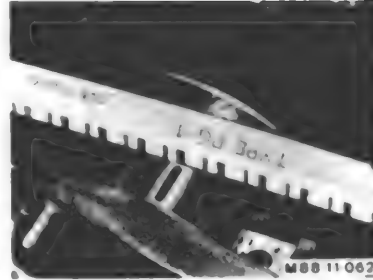
Check the ground size of main bearing journals.

Install bearing shells in the crankcase with the same color code mark as the dot of paint on the console.
Install both bearing shells according to the crankshaft color code mark, if the color code mark of the crankcase has been washed off.

Install crankshaft.
Place Type PG-1 Plastigage on crankshaft wiped clean of oil and tighten bearing caps with correct torque*.
Do not turn the crankshaft.

Source of Supply for Plastigage:
CARTOOL
Alfred-Brehm-Str. 5
D-9070 Ingolstadt

* See Specifications



Remove bearing caps.
Read bearing play* by measuring the width of the flattened Plastigage with help of the supplied scale.
Correct the bearing play by installing new bearing shells, bearing shells of a different machined size or with a different color code.

Survey of Color Code: Shaft Diameter
Bearing Shell Thickness*

Double Classification Color Codes:
Rt = red
BI = blue

- 1 Crankshaft diameter
- 2 Bearing play
- 3 Bearing shell thickness
- 4 Console diameter

* See Specifications

11-811



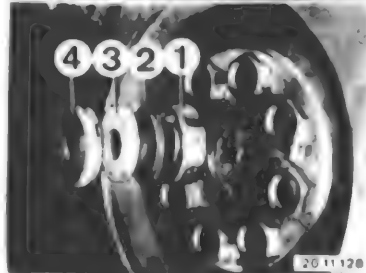
Crankshaft Assembly

- 1 Flywheel
- 2 Conrod bearing cap
- 3 Conrod bolt
- 4 Main bearing shell
- 5 Main bearing cap
- 6 Main bearing cap bolt
- 7 Main bearing shell
- 8 Thrust bearing
- 9 Piston
- 10 Connecting rod
- 11 Conrod bearing shell
- 12 Crankshaft
- 13 Woodruff key
- 14 Sprocket set
- 15 Vibration damper hub
- 16 Vibration damper
- 17 Pulley

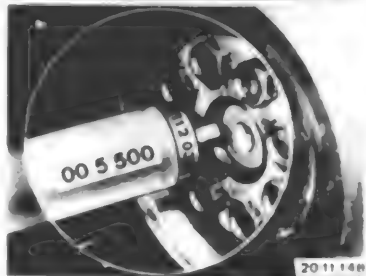


11 21 571 REPLACING PILOT BEARING IN CRANKSHAFT

Remove clutch disc 21 21 000
Pull out ball bearing with Special Tool 11 2 010.

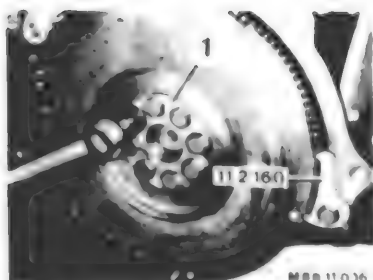


Installed Order:
Ball bearing (1)
Cover (2)
Felt ring (3)
Capsule (4)
Install cover (2) with embossment facing out



Pack bore in crankshaft with approx. 1 gram of lubricating grease
Drive in pilot bearing with Special Tools 11 2 030 and 00 5 500

11-812



MBB 11 036

11 22 000 REMOVING AND INSTALLING FLYWHEEL

Remove clutch 21 21 000.
Hold flywheel with Special Tool 11 2 160.
Unscrew bolts and take off flywheel.

Installation:

Clean tapped bores.
Install disc (1).
Replace and install expansion bolts with Loctite No. 270**.
Tightening torque*

Check axial runout* of flywheel.

Friction surface may be machined to minimum thickness A*.
If machining the friction surface reduces distance "h" to zero, flange surface (distance "h") has to be machined.

MBB 11 072

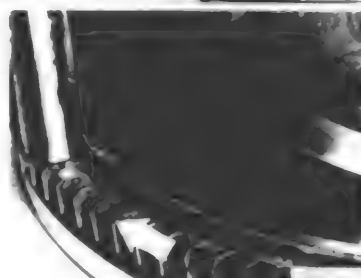


11 22 541 REPLACING STARTER GEAR RING

Drill a 6 mm (0.236") dia. hole approx. 8 mm (0.315") deep below a tooth gap to make breaking the ring easier.



Break gear ring at drilled point with a chisel.



Installation:

Heat new gear ring to 200 ... 230° C (395 to 445° F), checking temperature with a thermochrome pencil.
Tooth bevel faces engine.
Install starter gear ring to fit snugly all around with a brass mandrel.

* See Specifications
** Source: HWB

11-813

11 23 000 REMOVING AND INSTALLING VIBRATION DAMPER WITH HUB

Remove radiator 17 11 000
Remove fan 11 52 000
UnscREW brace

Hold flywheel with Special Tool 11 2 100

Take off drive belts on alternator, power steering pump and, if applicable, compressor for air conditioner.

UnscREW nut (1) with Special Tool 11 2 180

Installation

Tightening torque*

Tighten drive belts and check tightness with Special Tool 11 5 020

Pull off vibration damper with hub.

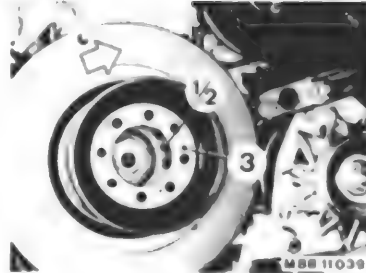
Installation

Check for correct installed position of key (2).

Check seal, replacing if necessary.

If hub is worn, install seal approx. 1 to 2 mm (0.039 to 0.079") deep.

* See Specifications



11 23 010 REPLACING VIBRATION DAMPER

Remove fan cowl.

Take off drive belts on alternator, power steering pump and, if applicable, compressor for air conditioner.

UnscREW pulley and remove vibration damper.

Installation

- Dowel pin (1) to bore (2)

- Bore (3) to bore (2)

Vibration Damper Identification.

Type	Dia (mm)	BMW Number	Color Code
M 88/3	245	1 305 802	white
S 38 Z	245	1 309 236	blue

Tightening torque*

Tighten drive belts and check tightness with Special Tool 11 5 020

11 23 031 REPLACING HUB OF VIBRATION DAMPER

Remove vibration damper with hub 11 23 000.

UnscREW pulley and remove vibration damper.

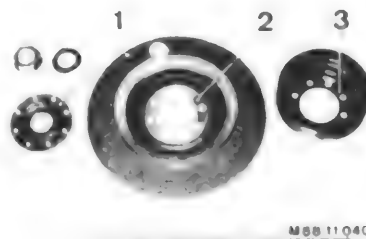
Installation

- Dowel pin (1) to bore (2)

- Bore (3) to bore (2)

Tightening torque*.

* See Specifications



11-814

11 24 521 REPLACING CONNECTING RODS - Pistons Removed -

Note

Only install connecting rods of same weight class (die-stamped in bearing caps) in one engine.

Consequently only sets of connecting rods are available from Parts.

The piston pin must slide through the conrod bush under light pressure.
Install conrod bearing shells - see 11 24 571.

MBB 11 064

MBB 11 065

11 24 571 REPLACING CONROD BEARING SHELLS - Engine Disassembled -

Place conrod bearing shells in connecting rods and conrod bearing caps. Check the machined size (conrod bearing diameter).

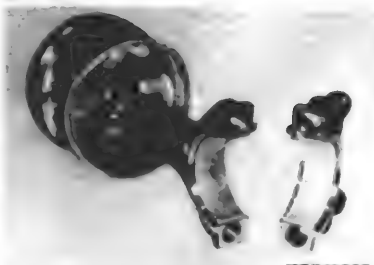
Place Plastigage (Type PG - 1) on conrod bearing journals wiped clean of oil in BDC position. Mount conrod bearing caps — pair codes and grooves of bearing shells must be on the exhaust side.

Source of Supply for Plastigage:
Cartool
Alfred-Brehm-Str. 5
D-8070 Ingolstadt

Tighten bolts (use old conrod bolts). Tightening torque*. Don't turn the crankshaft. Remove conrod bearing caps. Read the conrod bearing play* from the supplied scale by measuring the width of the flattened Plastigage.

Use new bearing shells or shells of different machined size or with different color code to correct the bearing play.
Use new conrod bolts for final installation.

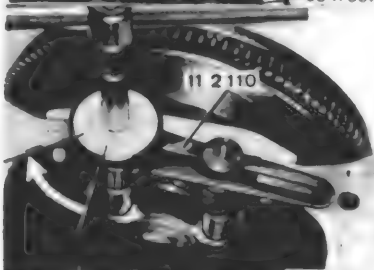
* See Specifications



MBB 11 066



MBB 11 067



MBB 11 068

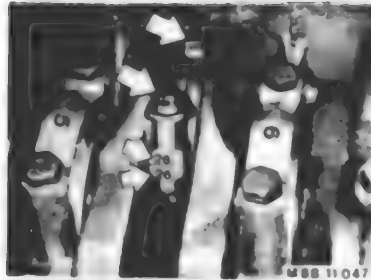


MBB 11 069

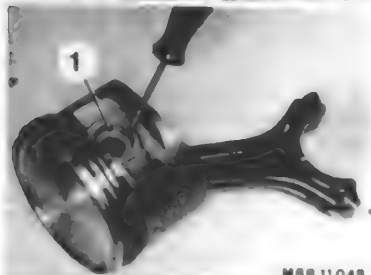
11-815

11 25 000 REMOVING AND INSTALLING PISTON - Engine Removed -

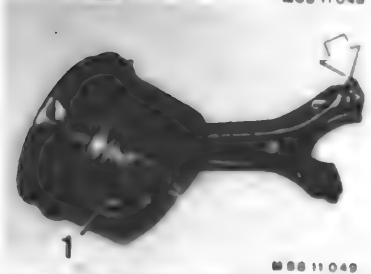
Remove cylinder head 11 12 100.
Remove oil pump 11 41 000.
Take off connecting rod bearing cap and press out piston with connecting rod upwards.
Installation
Install connecting rod 11 24 571.



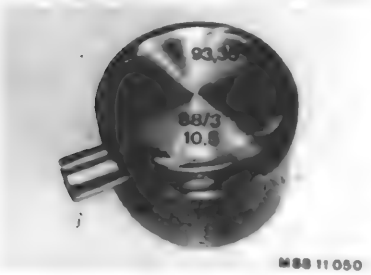
M88 11 047



M88 11 048



M88 11 049



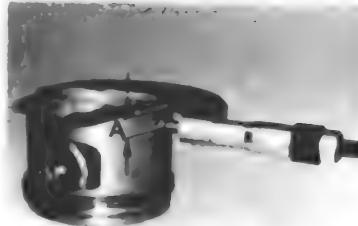
M88 11 050

Only install a piston of same make and same weight class.
Weight class is stamped with "+" or "-" in piston crown.
Identification:

Engine	E*	Dis. in mm
M 88/3	10.5	93.4
S 38 Z	9.8	93.4

Check machined size (piston diameter)*.

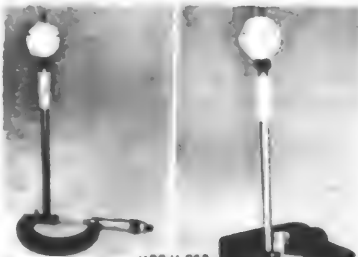
* See Specifications



M88 11 051

Measuring Piston Installed Clearance:
Measure piston diameter* at measuring point "A" with a micrometer.

Engine	Make	Measuring Point "A" in mm
M 88/3	Mahle	11 (0.433")
S 38 Z	Mahle	6 (0.236")

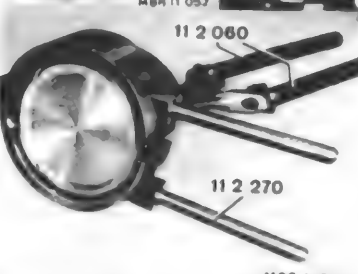


M88 11 052

Set internal calipers to zero on micrometer with the measured piston diameter.

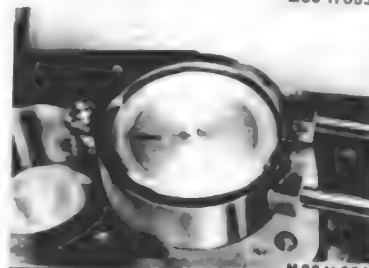
Measure cylinder bore with internal calipers at bottom, center and top in forward and rotational directions.

Compare measured piston installed clearance with specified piston installed clearance*.
Max. permissible wear clearance*.



M88 11 063

Bolt Special Tool 11 2 060 on connecting rod.
Lubricate piston and piston rings with oil.
Offset piston ring and gaps by 120°.
Compress piston rings with Special Tool 11 2 270



M88 11 054

Install piston that arrow faces timing chain.
Turn pertinent connecting rod bearing journal to BDC to install piston.

* See Specifications

11-816

11 23 651 REPLACING PISTON RINGS OF ONE PISTON - Piston Removed -

Remove piston rings with a piston ring
compressing pliers.

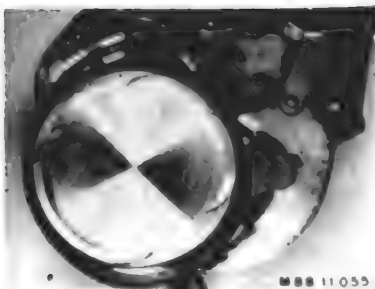
Note

It might not be possible to find the identifi-
cation on used piston rings.
Lay piston rings aside in correct sequence
and installed position.

Installation

Install piston rings with the word "TOP"
facing the piston crown.

- 1 Plain compression ring
- 2 Bevelled compression ring
- 3 Oil scraper ring with rubber lined spring



Measure side clearance*



Measure end clearance*

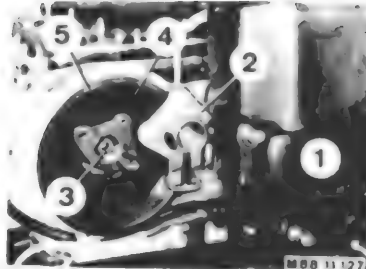
* See Specifications



Valve Timing

- 1 Camshaft 264° - M 88 - 3
- Camshaft 248° - S 38 Z
- 2 Camshaft oil bore plug
- 3 Circlip
- 4 Cylindrical pin - different for intake and exhaust sprockets. New uniform pin for intake and exhaust is retroactively interchangeable
- 5 Sprocket - intake "E"
- 6 Sprocket - exhaust "A"
- 8 Lockplate
- 9 Hex. head screw M 6 x 16
- 10 Adapter for distributor rotor
- 11 Intake valve - 37 mm dia. (larger stem diameter valves available for repairs)
- 12 Exhaust valve - 32 mm dia. (larger stem diameter valves available for repairs)
- 13 Lower valve retainer
- 14 Valve stem seal
- 15 Valve spring - 42.5 mm long (double spring set can be installed retroactively with new spring retainers)
- 16 Upper spring retainer
- 17 Valve collets
- 18 Plunger (larger plunger dia. for S 38 Z)
- 19 Shims from 3.00 to 4.25 mm

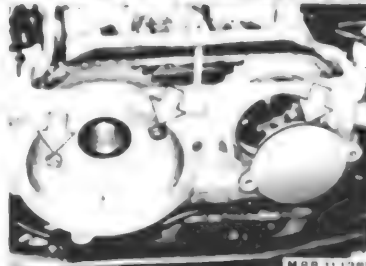
11-817



11 31 000 REMOVING AND INSTALLING CAMSHAFT

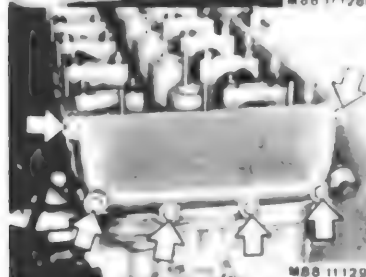
Remove cylinder head cover - see 11 12 000
 Remove fan cowl and fan - see 11 52 000
 Remove distributor cap (1)
 Unscrew distributor rotor (2)
 Unscrew adapter (3)
 Remove cover (4).

Installation
 Check O-ring (5), replacing if necessary
 Tightening torque*.



Unscrew distributor housing and end cover

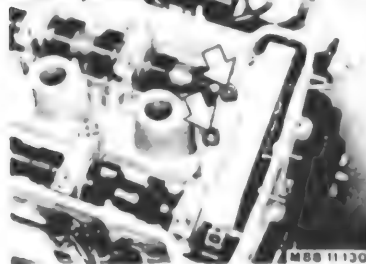
Installation
 Check O-ring, replacing if necessary



Unscrew end cover

Installation
 Replace gasket.

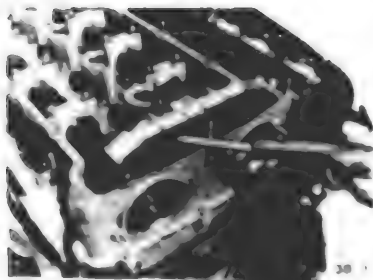
Important!
 Use new bolts coated with microencapsulated cement to prevent oil leakage



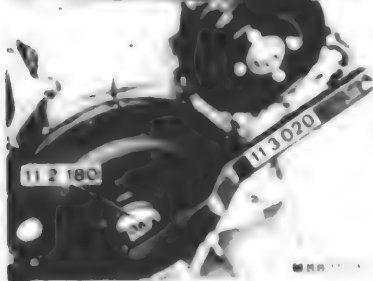
Unscrew guide rail

* See Specifications

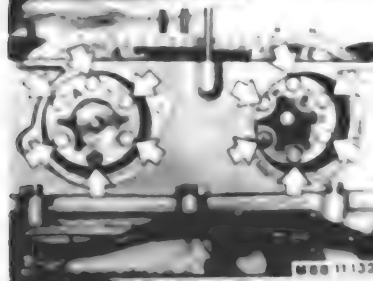
11-818



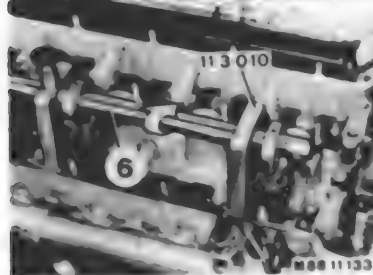
Installation
Center guide rail with a feeler gage blade



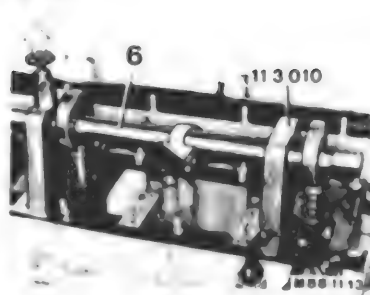
Turn crankshaft with Special Tool 11 3 020 to set cylinder 1 to TDC – cyl 6 overlaps
CAUTION
Never crank the engine after removing the timing chain



Remove chain tensioner – see 11 31 090
Open lockplates and unscrew sprockets

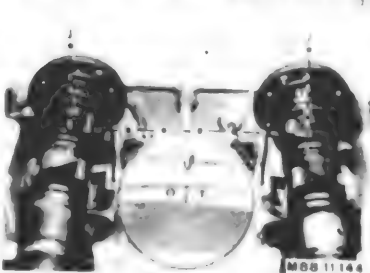


Mount Special Tool 11 3 010 on timing case. Turn shaft (6) up to the stop – camshaft is held down for removal of bearing caps. Unscrew camshaft bearing caps.

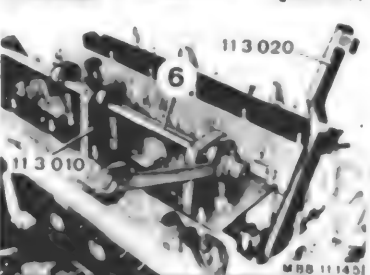


Release arrest and relax the camshaft. Remove Special Tool 11 3 010. Mark camshafts "E" / "A" and remove.

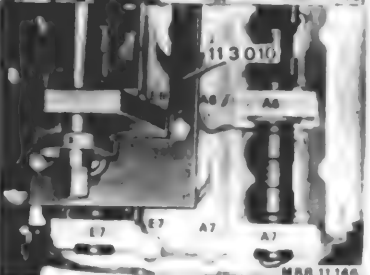
Installation
Intake and exhaust camshafts are identical. Used camshafts must be installed in the same position



Installation
Turn crankshaft to TDC. Install camshaft that one each groove faces up and in – TDC position



Mount Special Tool 11 3 010 on timing case. Hold camshaft in TDC position with Special Tool 11 3 020 and turn shaft (6) up to the stop – camshaft is held down for installation of bearing caps.

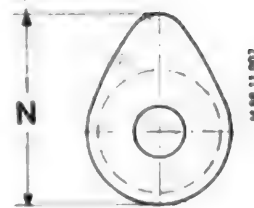


Install camshaft bearing caps on timing case according to the lettering. Tightening torque*.

* See Specifications

11-819

Tighten the timing chain in opposite direction of engine rotation and place on the intake sprocket "E" first.
Install lockplate and tighten sprocket.
Tightening torque*



11 819 007

Cam distance "N"°.

Installation:
Install exhaust sprocket "A".
Insert adapter (7).
Install lockplate and tighten sprocket.
Tightening torque*

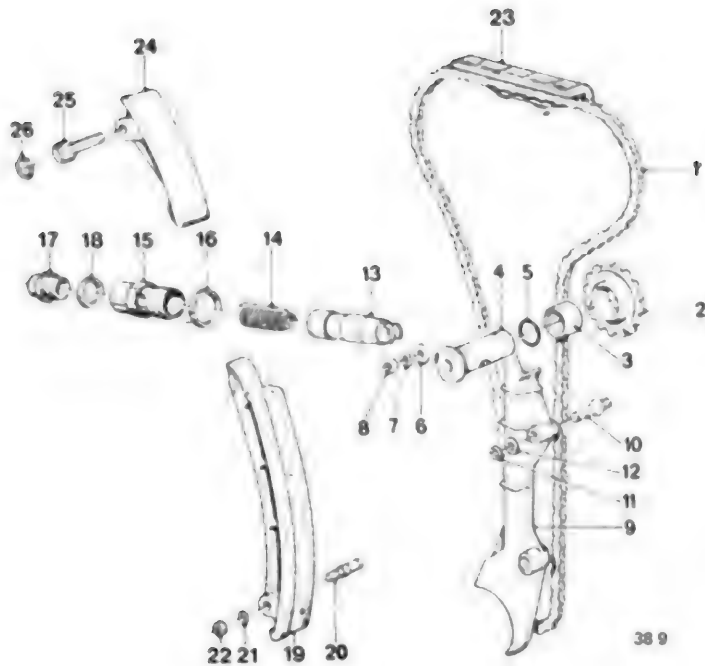
Install chain tensioner – see 11 31 090.
Crank engine once in direction of rotation and recheck the timing:
– Crankshaft in TDC
– One each camshaft groove faces in
– One each camshaft groove faces cast boss on bearing cap

Lock sprocket mounting bolts with the lockplates.
Adjust valve clearance – see 11 34 004.

* See Specifications

* See Specifications

11-820

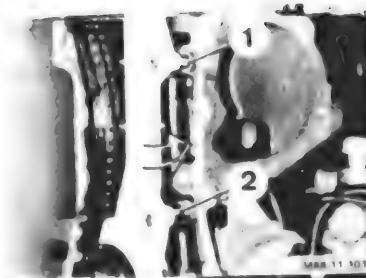


Valve Timing

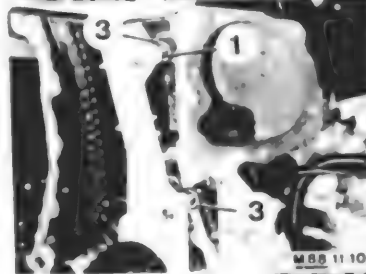
- | | |
|--------------------------|----------------------------|
| 1 Timing chain | 14 Spring |
| 2 Sprocket (guide wheel) | 15 Cylinder |
| 3 Needle sleeve | 16 Seal |
| 4 Shaft | 17 Plug |
| 5 O-ring | 18 Seal |
| 6 Shim | 19 Tensioning rail (lower) |
| 7 Spring washer | 20 Bearing pin (hollow) |
| 8 Nut | 21 Lock washer |
| 9 Guide rail | 22 Retainer |
| 10 Bearing pin | 23 Guide rail |
| 11 Lock washer | 24 Tensioning rail (upper) |
| 12 Shim | 25 Bearing pin |
| 13 Piston | 26 O-ring |

11 31 051 REPLACING TIMING CHAIN

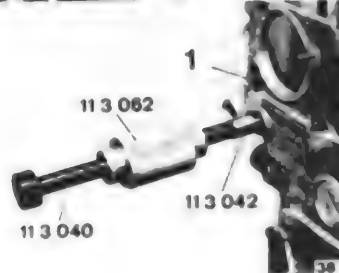
Remove lower timing case cover 11 14 110
Remove sprockets on camshafts, see 11 31 000
Remove water pump 11 51 000.



Unscrew bolts (1 and 2).
Unscrew screw (2) and swing guide rail guide.
Installation:
Place timing chain on crankshaft sprocket and reversing wheel before swinging in the guide rail.



Unscrew bolt (1) and take off guide rail.
Remove timing chain.
Installation:
Timing chain is pre-stretched.
Use washers (3).



11 31 ... REMOVING AND INSTALLING UPPER TENSIONING RAIL

Remove timing chain - see 11 31 051.
Loosen bolt (1) and screw in Special Tools 11 3 040, 11 3 062 and 11 3 042.
Knock out shaft.
Installation:
Check O-ring, replacing if necessary.

11-821

11 31 061 REPLACING SPROCKET SET Timing Chain Removed

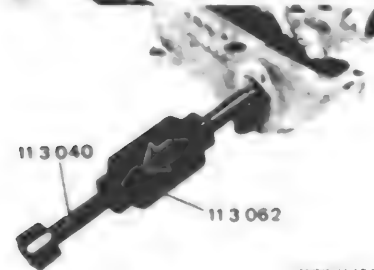
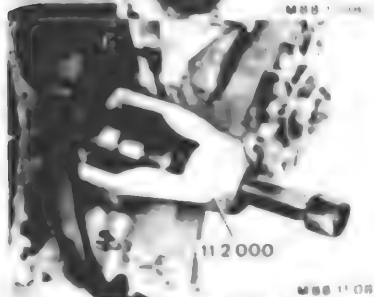
Remove oil pan 11 13 000
Remove sprocket (1) on oil pump
Take off chain
Lift out woodruff key (2)

Pull off sprocket with Special Tool 11 2 000
Heat sprocket to max. 200° C (390° F) for installation
Tighten oil pump chain, see 11 41 000

Apply Special Tools 11 3 040 and 11 3 062
on shaft of chain guide wheel
Knock out shaft

Installation

Replace O-ring (3)
Drive in shaft (with bore facing up) partially
Push on guide wheel sprocket
Drive in shaft against stop



Installation
Check needle sleeve in sprocket, replacing if necessary
Forward direction and pressing in direction for needle sleeve



11-822

11 31 090 REMOVING AND INSTALLING PISTON FOR CHAIN TENSIONER

Unscrew plug (1)
Take off damper housing (2)
Installation:
Replace seal (3)
Tightening torque = 25 ± 3 Nm (18 \pm 2
ft lbs.)

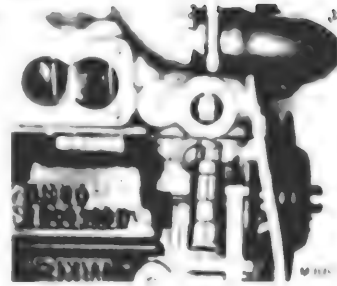
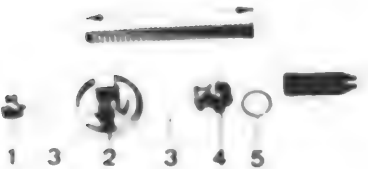
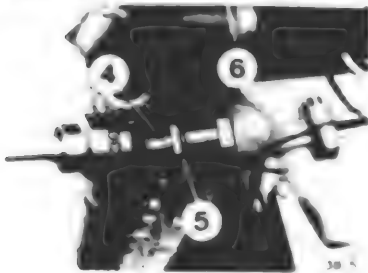
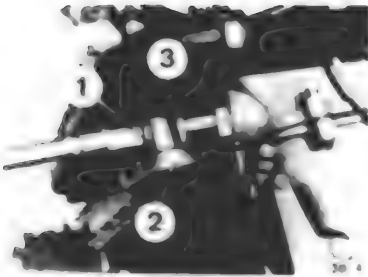
Unscrew connector (4)
Caution!
Strong spring pressure
Remove spring and piston
Installation:
Replace seal (5)
Tightening torque for connector (4) =
 40 ± 3 Nm (29 \pm 2 ft lbs.)

Tightening torque for cylinder (6) =
 50 ± 3 Nm (36 \pm 2 ft lbs.)
Installation:
Check length of spring
Nominal value: 159 ± 0.5 mm (6.260
 \pm 0.020")
Conically wound end of spring faces the
CONNECTOR

Piston and cylinder are matched* with each
other - marked 1 or 2
Only install parts with same marks
Install cylinder with groove facing back (as
seen looking forward in car) and piston
with groove facing up

* See Specifications

Guide piston opening into tensioning rail.
Piston is operated by engine oil pressure.



11-823

11 34 004 ADJUSTING VALVE CLEARANCE

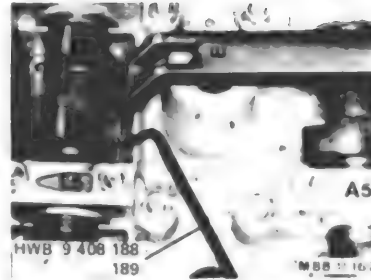
Remove fan cowl and fan - see 11 52 000
Remove cylinder head cover - see 11 12 000
Crank engine with Special Tool 11 3 020

Measure valve clearance with cams facing up.
Compare measured valve clearance with the specified valve clearance*.

Turn openings of tappets as shown in the picture, if the measured valve clearance is not within specified valve clearance tolerances

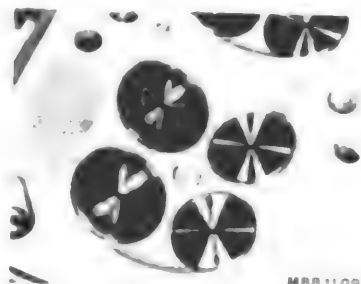
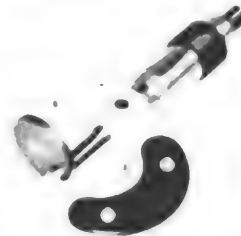
Guide in Special Tool 11 3 150 for M 88 - 3 engines or 11 3 170 for S 38 engines in accordance with camshaft "A" or "E" and press tappets down

* See Specifications



Blow out the valve shim with compressed air.

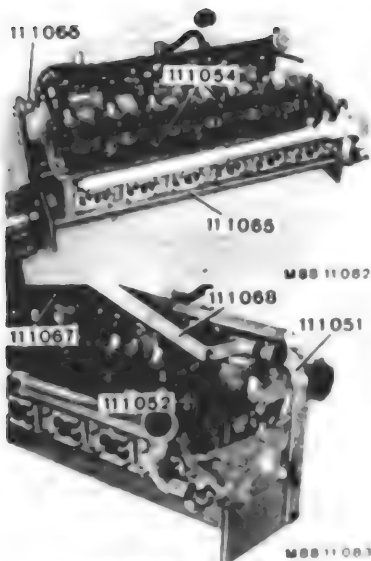
Measure thickness of removed valve shim
Install shim of required thickness with the lettering facing down



11 34 509 CHECKING VALVES FOR LEAKS - Cylinder Head Removed

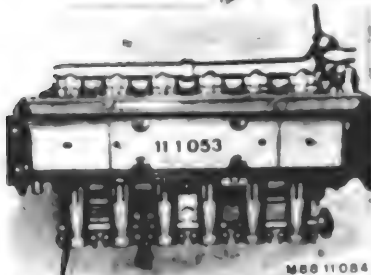
Spark plugs remain screwed in.
Fill combustion chamber with gasoline outdoors or indoors with conformance of fire prevention regulations.
If gasoline runs past valve heads, valves and valve seats must be inspected.
Remove valves - see 11 34 560.
Machine valve seats - see 11 12 607.

11-824

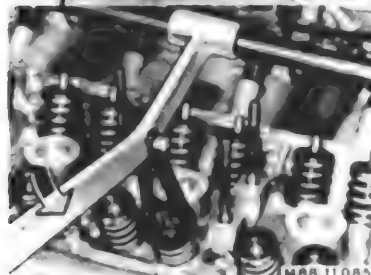


11 34 550 REMOVING AND INSTALLING VALVES - Cylinder Head Removed -

Mount cylinder head on Special Tool 11 1065 with Special Tool 11 1054
Bolt down Special Tool 11 1065



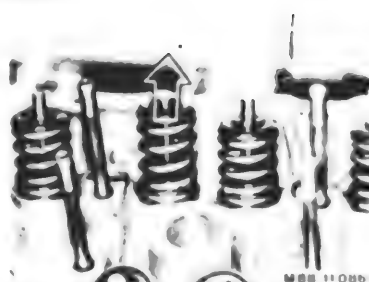
and 11 1051
Mount Special Tool 11 1068 with Special Tools 11 1052 and 11 1067
Unscrew spark plugs
Installation
Tightening torque*



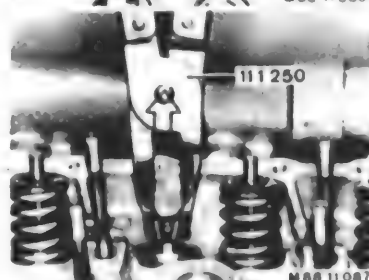
Place Special Tool 11 1053 (tray) in assembly fixture

Compress valve springs and remove valve collets

* See Specifications of Group 12



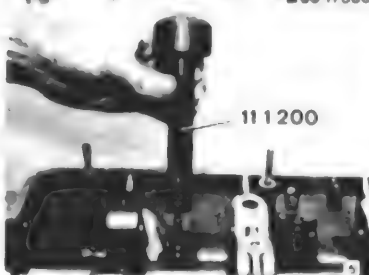
Remove upper spring retainer and valve springs
Take tray out of assembly stand and pull out valve
Installation
Lubricate valve guide and valve stem with oil
Double spring set can be installed retroactively together with the new spring retainers



Pull off valve stem seal with Special Tool 11 1250
Check valve guide for wear - 11 12 595

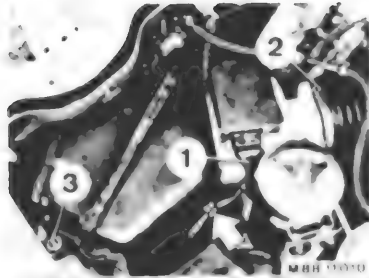


Install valves and place Special Tool 11 1063 (tray) in fixture
Use Special Tools 11 1360 (sleeves) to avoid damaging the valve stem seals
Lubricate valve stem seals (2) with oil and install
Source for Sleeves:
Cartool
Alfred Brehm Str. 5
D-8070 Ingolstadt



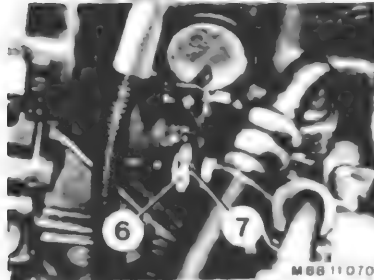
Press on valve stem seal against stop with Special Tool 11 1200.
New, improved valve stem seals with grooves on the inside are pressed on by hand with Special Tool 11 1200.
Special Tool 11 1200 has two diameters - for 7 mm (0.276") and 8 mm (0.315") valve stem seals.

11-825

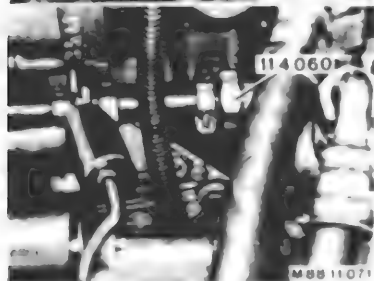


11 40 000 CHECKING ENGINE OIL PRESSURE

Pull off plug (1) and lift out wires
Unscrew hose clamp (2)
Unscrew nut (3) and remove air cleaner with air flow sensor

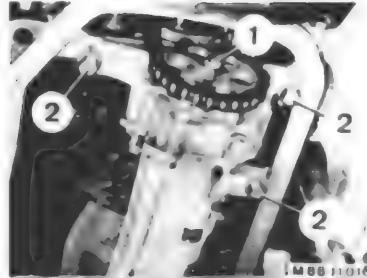


Pull off plug on oil pressure switch
Unscrew oil pressure switch (6)
Installation:
Check seal (7), replacing if necessary



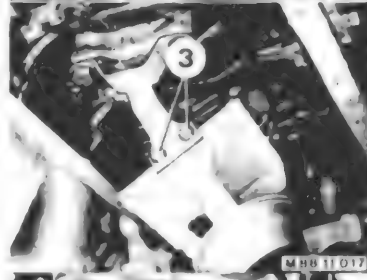
Screw in Special Tool 11 4 060
Connect 10 bar (142 psi) pressure tester of BMW service test unit
Install manifold
Check oil pressure*

* See Specifications



11 41 000 REMOVING AND INSTALLING OIL PUMP

Pull out oil dipstick
Remove oil pan 11 13 000
Unscrew nut (1) and take off sprocket
Unscrew bolts (2)



Unscrew bracket (3) and remove oil pump
Installation:
Mount bracket without tension



Installation:
Push on sprocket with oil pump mounted
Tightening torque* for nut



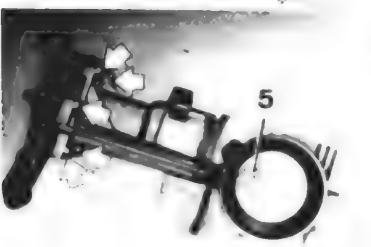
Installation:
Adjust chain tightness with shims (4 and 5) that chain gives under light thumb pressure
Shims (4) and (5) must have the same thickness.

* See Specifications

11-826



Testing and Servicing:
Check movement of oil pump by turning on the drive shaft.

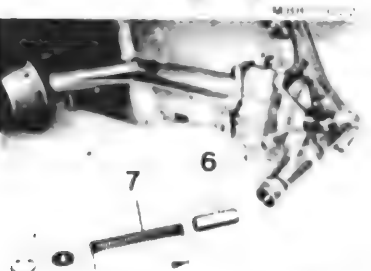


Disassemble oil pump and clean oil filter screen (5).

M88 11 021



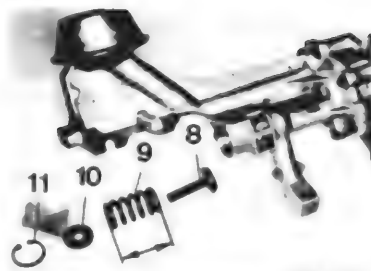
Check oil pump for wear:
- scoring in body
- wear of rotors



Pressure relief valve is installed in main bore and regulates the engine oil pressure*, see 11 40 000.
Check movement of piston (6).
Check length of spring (7) = 68 mm (2.677").

M88 11 023

* See Specifications

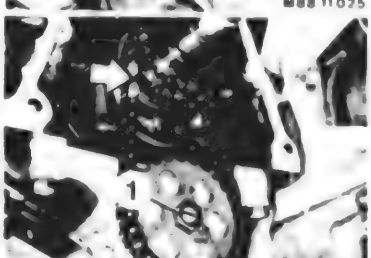


The 8 bar (114 psi) pressure relief valve regulates oil pressure in front of the oil filter and prevents oil filter leakage.
Check seating of piston (8).
Check length of spring (9) = 44 ± 0.4 mm (1.732 ± 0.016").

M88 11 024



Installation
Push in spring (9) and washer (10) with a wrench socket and install circlip (11).



M88 11 025

11 41 151 REPLACING OIL PUMP DRIVE CHAIN

Remove oil pan 11 13 000.
Remove timing chain 11 31 051.
Unscrew nut (1) and remove sprocket.
Installation
Adjust chain tightness, see 11 41 000.
Chains with green color code are longer than chains with red color code.
Tightening torque*.

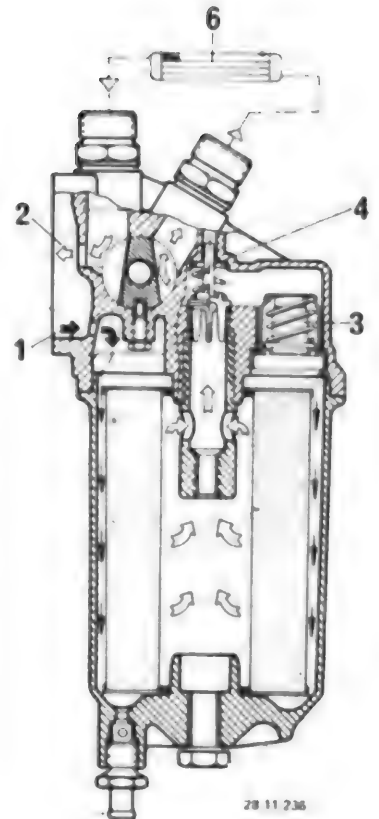
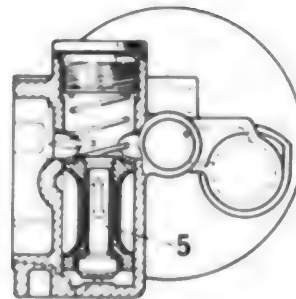
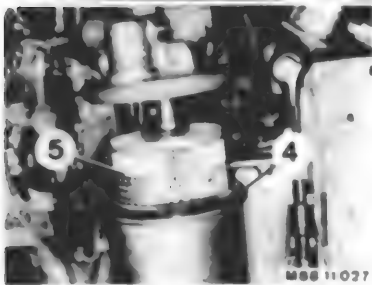
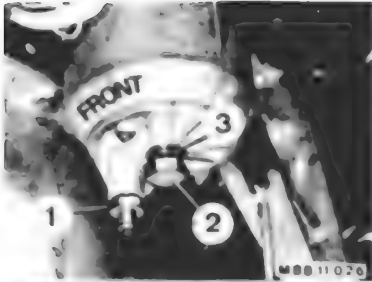
* See Specifications

11-827

11 42 021 REPLACING FULL FLOW OIL FILTER

Unscrew oil drain plug (1) and drain oil
Unscrew bolt (2)
Replace oil filter (5)

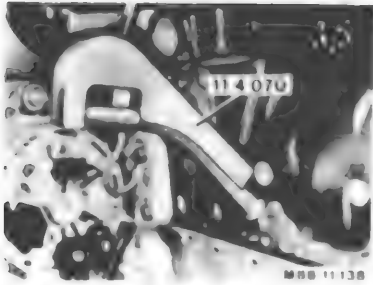
Inspection:
Check seals (3 and 4), replacing if necessary.
Mount oil filter housing that arrow faces forward (FRONT).
Tightening torque*
Add engine oil***



- 1 Feed from oil pump
- 2 Return to main oil bore
- 3 Bypass valve - opening pressure 2.5 : 0.25 bar (35 : 3.5 psi)
- 4 Return inhibiting valve - opening pressure 0.1 : 0.05 bar (1.4 : 0.7 psi)
- 5 Thermostatic activator for switching oil cooler
- 6 Oil cooler

* See Specifications
*** See Service Information of Gr. 00

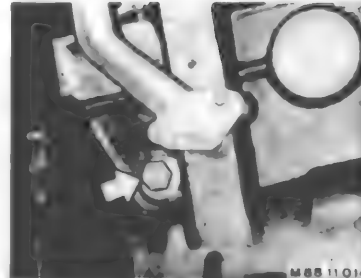
11-828



M 88 11 138

11 43 101 REPLACING GUIDE TUBE FOR OIL DIPSTICK

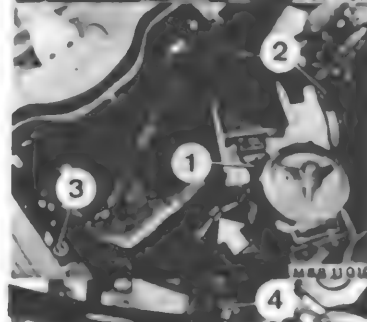
Install guide tube with Loctite No. 270** and drive in against stop



M 88 11 014

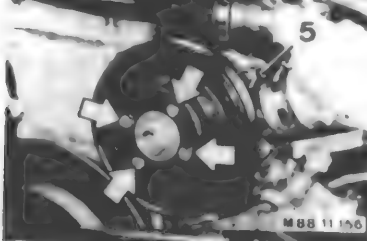
11 51 000 REMOVING AND INSTALLING REPLACING WATER PUMP

Unscrew bolt and drain coolant.
Remove fan cowl and fan 11 52 000.
Installation:
Add coolant***.



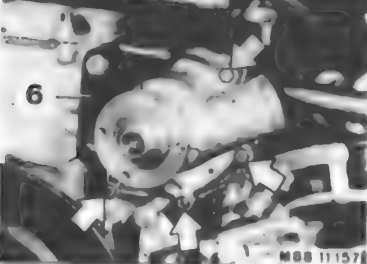
M 88 11 016

Pull off plug (1) and lift out wires.
Unscrew hose clamp (2)
Unscrew nut (3) and remove air cleaner with air flow sensor



M 88 11 156

Take off drive belt and remove pulley.
Pull off hoses (4 and 5).
Installation:
Tighten drive belt and check tightness with Special Tool 11 5 020.



M 88 11 157

Unscrew suspension eye (6) and water pump.
Installation:
Replace gasket.

** Source: HWB

*** See Service Information of Gr. 00

11-830

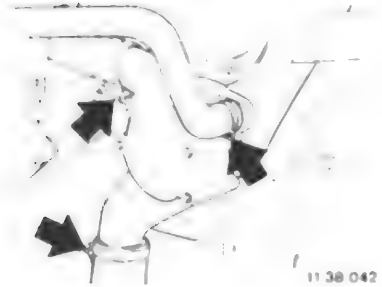
11 53 000 REMOVING AND INSTALLING OR REPLACING COOLANT THERMOSTAT

Disconnect coolant hoses on thermostat housing to the coolant pipe.



11 38 041

Unscrew bolts.
Lift off thermostat housing.

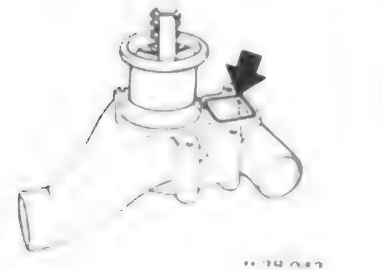


11 38 042

Pull thermostat out of the housing.

Installation

Replace rubber seal on the coolant port.
Check installed direction of the thermostat.



11 38 043

11-831

11 62 ... REMOVING AND INSTALLING
SEALING OR REPLACING
BOTH EXHAUST MANI-
FOLDS (S 38 B 36 Engine)
- Engine Removed -

Unscrew air Injection.
Unscrew holder for heat shield.

Unscrew and remove heat shield.

Unscrew air Injection pipe.

Note
Use Special Tool 11 6 070.

Important!
Unscrew holder on exhaust manifold at
cylinder no. 1.

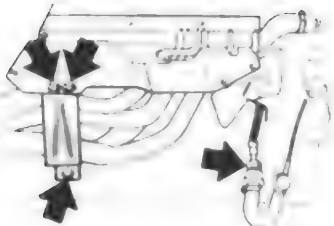
Installation
Replace gaskets.

Unscrew coolant pipes.

Installation
Replace seals.

Unscrew both exhaust manifolds on
the cylinder head.

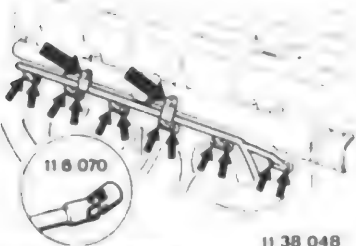
Note
Use Special Tool 11 6 070.



11 38 044



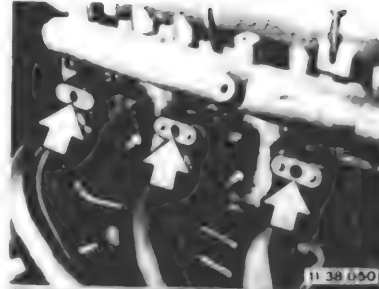
11 38 047



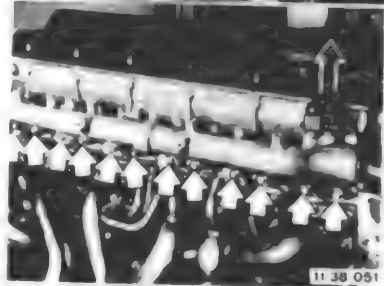
11 38 048



11 38 049



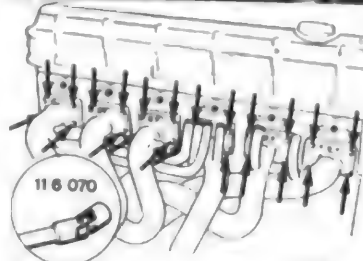
11 38 050



11 38 051



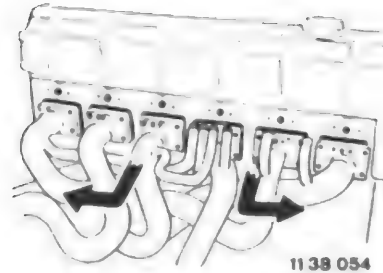
11 38 052



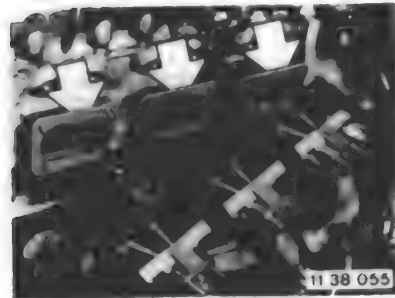
11 38 053

11-832

Lift both manifolds off of the staybolts.



11 38 054



Installation:

The graphite surface of gaskets faces the cylinder head.

Use new self-locking nuts.

Tightening torque = 10 ± 1 Nm
(7.2 ± 0.7 ft. lbs.).

33 10 Final Drive E32 / E34

Oil grade, refer to Operating Fluids		
Oil fill quantity for transmission type M (188) a)	approx. ltr.	1.7
Oil fill quantity for transmission type G b)	approx. ltr.	1.9

a) side cover with 6 screws

b) side cover with 8 screws

33 12 Crown wheel with pinion and bearing (Type K, M, G)

	Type	Thread	Tightening specification	Measure
1AZ Crown wheel on final drive housing Always replace screws, ensuring screws are free of oil and grease, then secure screws with Loctite 270	All	M10	Jointing torque	50 + 3 Nm
			Torque angle	40 + 3 °
	All	M12 x 1.5	Jointing torque	100 + 10 Nm
			Torque angle	50 + 5 °
	All	M14 x 1.5	Jointing torque	100 + 10 Nm
			Torque angle	30 + 4 °
2AZ Input flange to drive pinion				
Type K (Side cover with 4 bolts); min.		M20		175 Nm
Type M (Side cover with 6 bolts); min.		M20		185 Nm
Type G (Side cover with 8 bolts); min.		M22		210 Nm

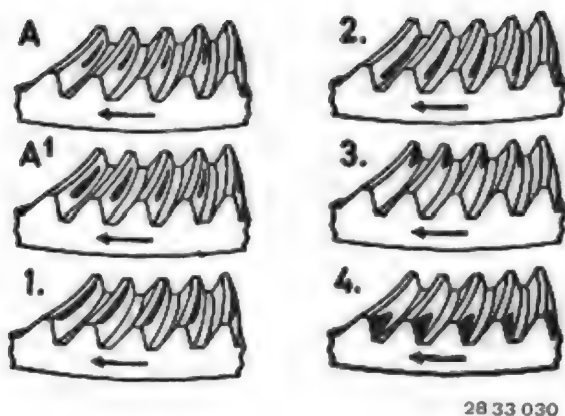
		thread	tightening specification	
Designations				
Type K = Side cover with 4 screws				
Type M = Side cover with 6 screws				
Type G = Side cover with 8 screws				
168 / 168 / 215 / 220 compact = without side cover				

33 21 Output Shaft

	Type	Thread	Tightening specification	Measure
1AZ Output shaft to final drive unit and drive flange				
Fillister head bolt	All	M10		83 Nm
with locking teeth	All	M10	Replace bolts and washers	96 Nm
	All	M12		110 Nm
Torx bolt	All	M10		83 Nm
with ribbed teeth Color: BLACK	All	M10		100 Nm
	All	M8		64 Nm
with ribbed teeth Color: SILVER	All	M10	Replace screws	80 Nm
	All	M8		52 Nm
with ribbed teeth	All	M12		135 Nm

33 11 Rear Differential Case with Cover

	Type	Thread	Tightening specification	Measure
1AZ Case Covers	All	M10 8.8		45 Nm
	All	M10 10.9		90 Nm
	E60 / E65 / E66	M10x75 10.9		110 Nm
	E63 / E64	M10x75 10.9		90 Nm
	E60 / E63 / E64 / E65 / E66	M10x25 10.9		90 Nm
	E85	M10 8.8		55 Nm
	E83	M10 10.9		55 Nm
2AZ Side bearing cap (insert into through bore-holes only new coated screws or screws with Loctite 270) Differential designations	Type M, G	M8		22 Nm
	Type K	M8	Jointing torque Torque angle	10 + 2 Nm 40 + 5 °
3AZ Oil fill and drain plug with sealing ring	All			65 Nm
4AZ Drive flange, right	E34 / Four Wheel Drive	M10		59 Nm
5AZ Drive flange, left (always replace screws)	E34 / Four Wheel Drive	M14 x 1.5	Jointing torque	90 Nm
			Torque angle	100 + 4 °
6AZ Oil cooler connection to rear differential	E31			35 Nm
7AZ Union nuts pipe oil cooler	E31			17 Nm
8AZ Vibration damper on bracket	All			77 Nm
9AZ Oil filler and drain plugs with O-ring	All			60 Nm



28 33 030

A Correct tooth pattern without load

A1 Under load, the contact pattern moves slightly outwards.

Moving the ring gear will mainly change the backlash, but will also displace the contact pattern in longitudinal direction of the teeth. Moving the drive pinion will displace the contact pattern in favor of tooth height, but the backlash will be altered just very slightly.

Here are the four basically incorrect contact patterns, which usually occur in combination. Knowing these patterns will facilitate making adjustments.

1. High, narrow contact pattern (tip contact) on ring gear.

Move drive pinion toward ring gear shaft and perhaps correct backlash by backing ring gear off of drive pinion.

2. Deep, narrow contact pattern (root contact) on ring gear.

Move drive pinion away from ring gear shaft and perhaps correct backlash by moving in ring gear.

3. Short contact pattern on small tooth end (toe contact) of ring gear.

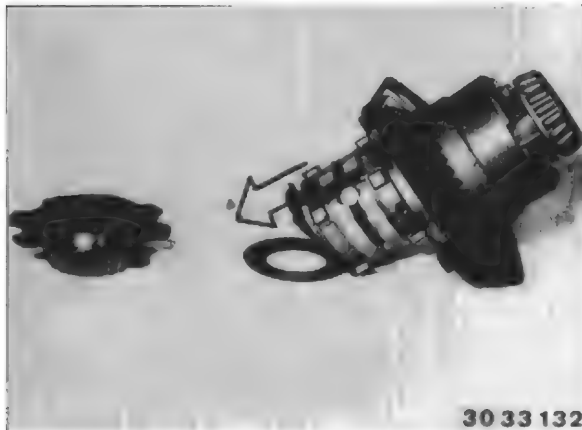
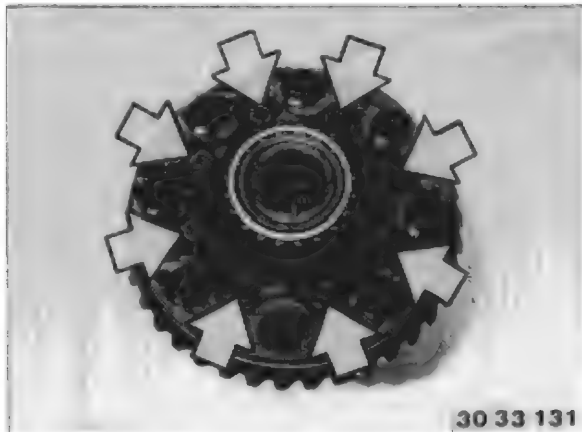
Move ring gear away from drive pinion. Maybe move pinion closer to ring gear shaft.

4. Short contact pattern on large tooth end (heel contact) of ring gear.

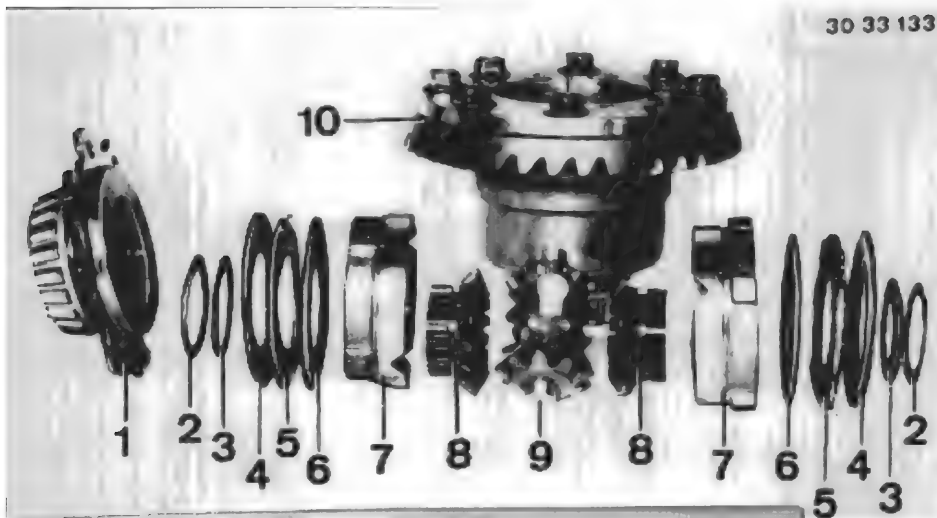
Move ring gear toward drive pinion. Perhaps back drive pinion away from ring gear shaft.

Removing limited-slip differential,
refer to 33 14 520

Unscrew case cover mounting bolts.
Take off case cover.



Carefully allow the components to slide out of the housing.



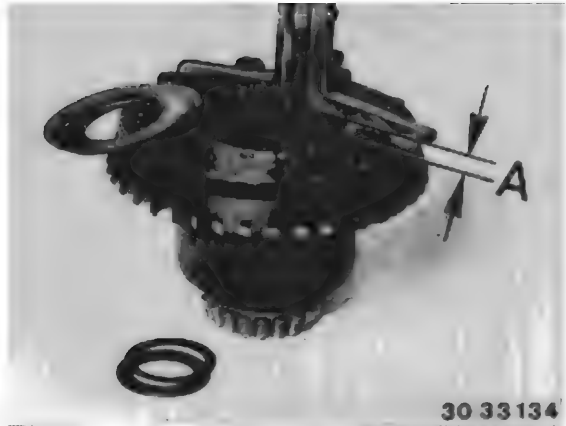
- 1) Housing cover
- 2) Plate spring
- 3) Thrust washer
- 4) Plate spring
- 5) Outer disc

- 6) Inner disc
- 7) Compression ring
- 8) Differential side gear
- 9) Final drive gears with differential shafts
- 10) Final drive housing

Check all parts for wear,
e.g. molybdenum coating, gears.

Installation:

Lubricate all parts with approved final drive oil before assembling.



Install following parts in correct installed order to measure the preload:

Outer plates (5), inner plates (6), thrust rings (7), differential side gears (8) and differential gears with differential shafts (9).

Measure dimension A from edge of housing to outer disc, e.g. A = 10.8 mm.

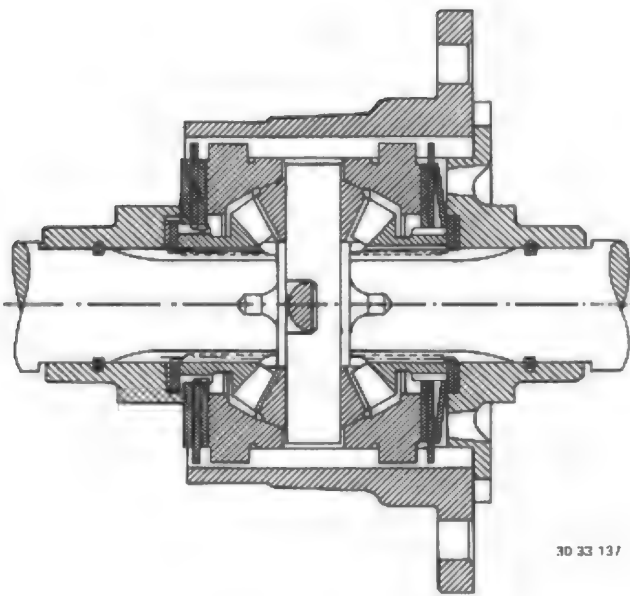


Measure dimension B on cover, e.g. B = 6.8 mm.



Place both diaphragm spring curved surfaces together.

Measure dimension C on the plate springs, e.g. C = 3.6 mm.



To ensure that the plate springs are not block-preloaded, installation clearance of 0.1 ... 0.4 mm is required.

Example:

B (cover) 6.8 mm

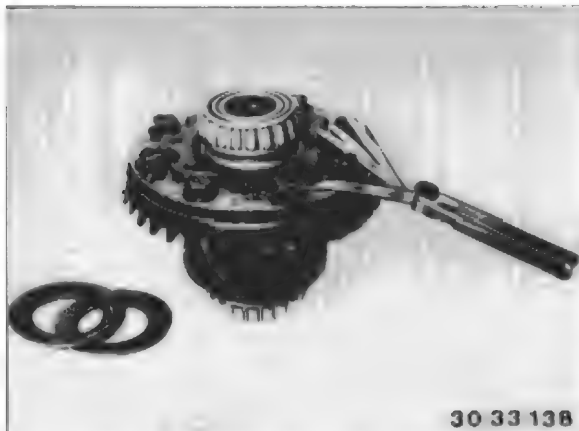
C (plate spring) 3.6 mm

A (housing) 10.8 mm

Sum total of B + C 10.4 mm

Installation clearance D 0.4 mm

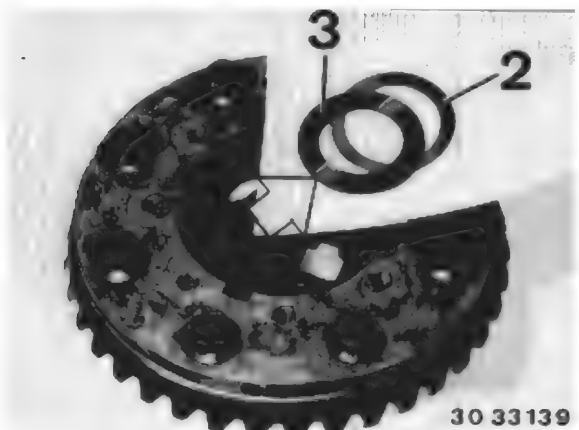
Correct any deviation in installed clearance D by installing outer plates of correct thickness.



Remove all parts from case and insert with the additional parts, diaphragm springs (2) and thrust washers (3). Mount case cover (1) and press on firmly, but do not bolt.

The preload of small diaphragm springs (2) should produce an uniform gap all around (check with feeler gage blade).

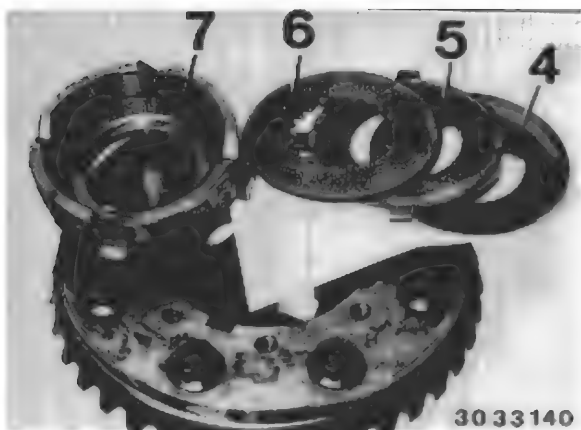
If there is no clearance between cover and case, check diaphragm springs (2) and thrust washers (3).



Installation:

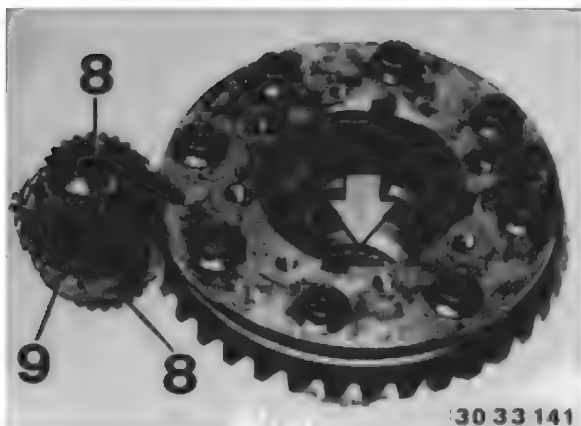
Diaphragm spring (2) with inside curved surface facing differential shaft (up).

Insert thrust washer (3) with oil pockets facing up to differential shaft.



Installation:

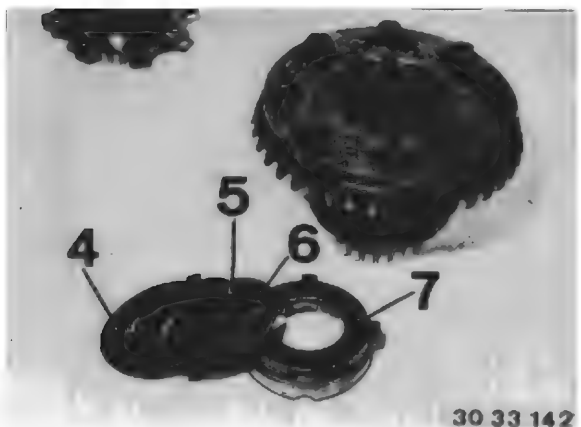
Insert diaphragm spring (4) with inside curved surface facing differential shaft and outer plate (5) with four tabs. Insert molybdenum coated inner plate (6) and thrust ring (7).



Installation:

Install differential side gear (8) by turning into guides or splines of inner plate.

Install differential gears with shafts (9) and a second differential side gear (8).



Installation:

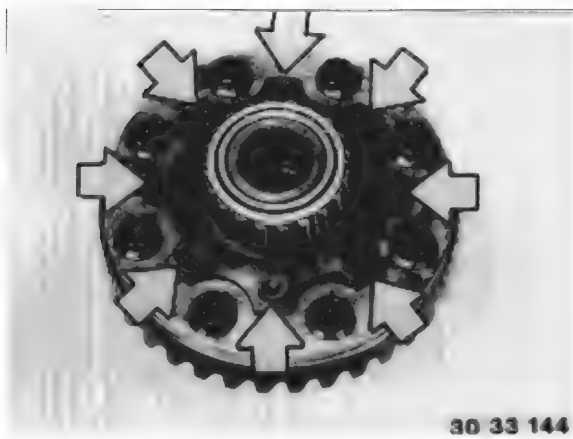
Install thrust ring (7), molybdenum coated inner plate (6) and outer plate (5).

Insert diaphragm spring (4) with inside curved surface facing differential shaft (down).



Installation:

Install diaphragm spring (2) with inside curved surface facing up and thrust washer (3) with oil pockets facing up in case cover, using grease.



Installation:

Mount case cover with washers (being careful that washers do not slide out).

Install bolts with Loctite No. 270 and tighten cover uniformly.

Tightening torque, refer to Technical Data

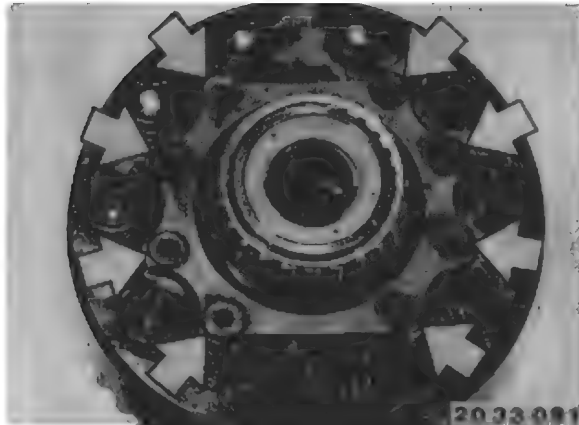


Check slip torque of limited slip differential, refer to Technical Data,

with one secured rear wheel and one driven rear wheel.

Make up tool locally for this purpose by, for example, welding a nut on a drive flange which is no longer required.

Removing limited-slip differential,
refer to Replacing complete limited-slip differential
33 14 520



Unscrew case cover mounting bolts.
Take off case cover.



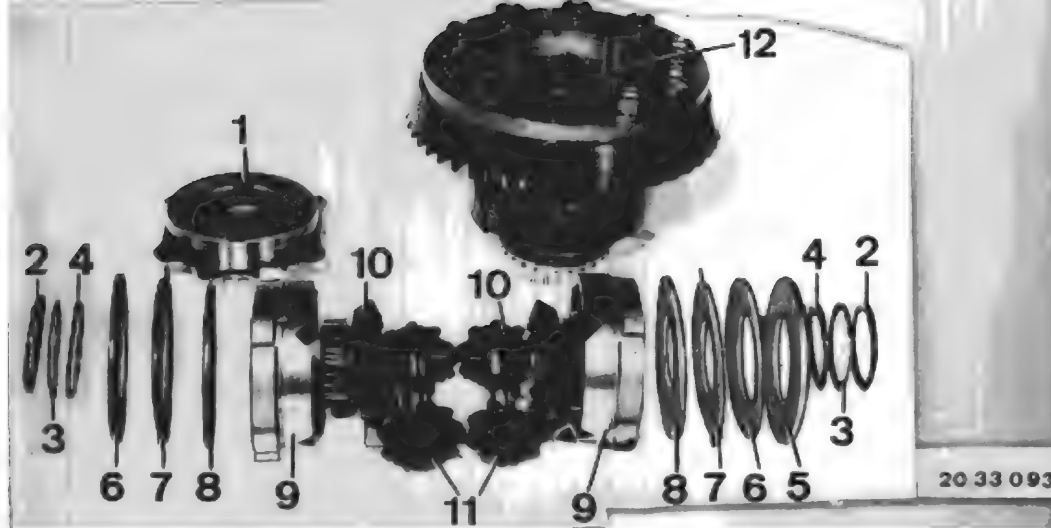
Carefully allow components to slide out of housing.

Installation:

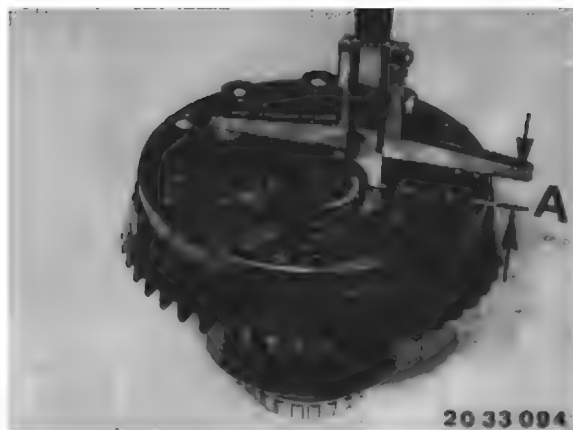
Check all parts for wear, e.g. molybdenum coating, gear and spline teeth.

Installation:

Lubricating all parts before assembly with approved grade of final drive oil.



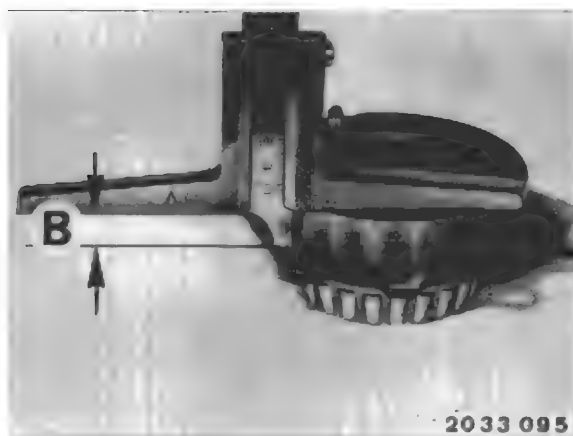
- | | | | |
|---|---------------|----|---|
| 1 | Housing cover | 7 | Outer disc |
| 2 | Thrust washer | 8 | Inner disc |
| 3 | Plate spring | 9 | Compression ring |
| 4 | Lug disc | 10 | Differential side gear |
| 5 | Spacer | 11 | Differential gears with differential shafts |
| 6 | Plate spring | 12 | Differential housing |



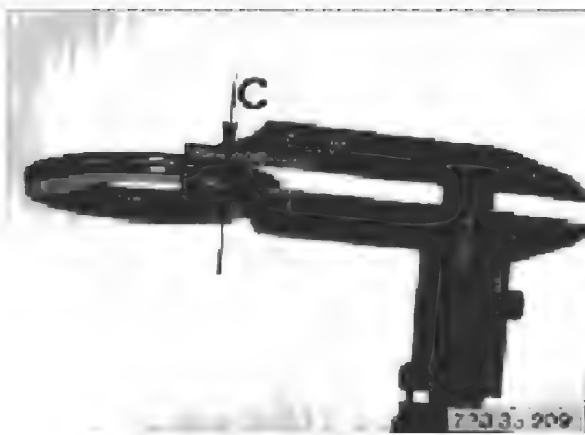
Install following parts in correct installed order to measure the preload:

Spacer disc (5), outer discs (7), inner discs (8), compression rings (9), rear axle shaft gears (10) and differential bevel gears and differential shafts (11).

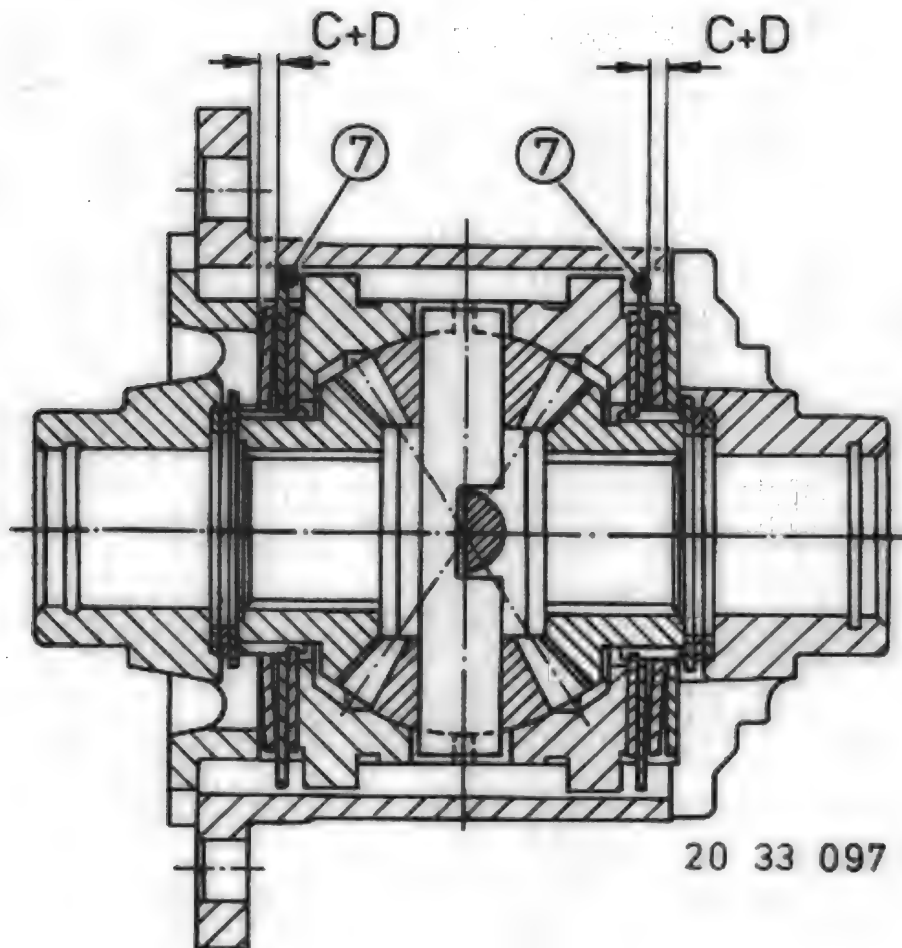
Measure dimension A from edge of housing to outer disc, e.g. A = 19.5 mm.



Measure dimension B on cover, e.g. B = 14.4 mm.



Place both diaphragm spring curved surfaces together.
Measure dimension C on the plate springs, e.g. C = 4.8 mm.



To ensure that the plate springs are not block-preloaded,
installation clearance of 0.1 ... 0.4 mm is required.

B (cover)	14.4 mm
C (plate spring)	4.8 mm

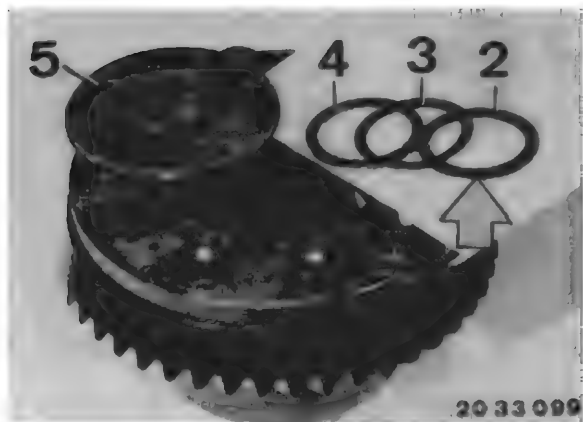
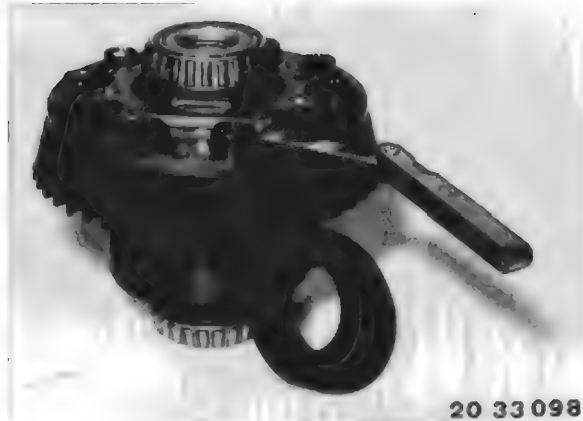
A (housing)	19.2 mn
Total of B + C	19.2 mn
Installation clearance D	0.3 mm

Correct any deviation in installed clearance D by installing outer plates of correct thickness.

Remove all parts from the housing and install with additional parts: thrust washers (2), plate springs (3) and lug discs (4). Mount case cover (12) and press on firmly, but do not bolt.

The preload on the small plate spring (3) should create an even gap all round (check with feeler gauge).

If there is no gap between cover and housing, check plate springs (3), thrust washers (2) and lug discs (4).

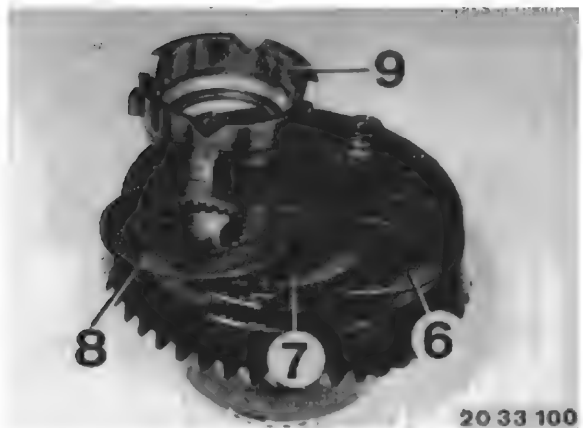


Installation:

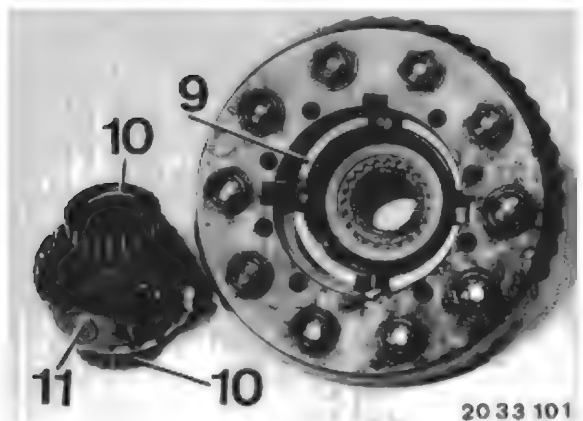
Thrust washer (2), with oil pockets facing the housing (downwards).

Diaphragm spring (3) with inside curved surface facing differential shaft (up).

The smooth side of the lug disc (4) faces the plate spring (downwards), the lug engages in the guide in the housing.

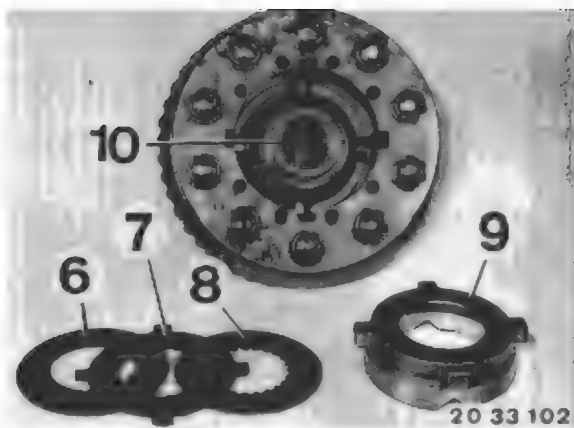


Install spacer disc (5), plate spring (6) with internal bulge facing differential shaft, outer disc (7) with the 4 lugs, then insert molybdenum-coated inner disc (8).

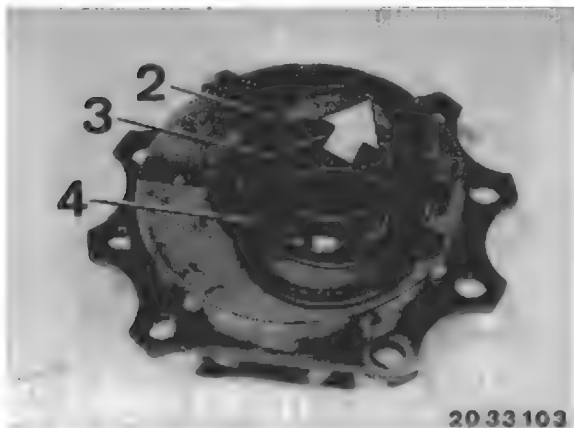


Install compression ring (9) and differential side gear (10) by twisting into the guide and/or spline of the inner disc.

Installing differential gears with shafts (11), second differential side gear (10) and compression ring (9).



Installing molybdenum-coated inner disc (8) and outer disc (7).
Insert diaphragm spring (6) with inside curved surface facing differential shaft (down).



Install thrust washer (2) with oil packet facing cover, plate spring (3) with inner bulge facing outwards and lug disc (4) with smooth side facing plate spring and lug in groove of housing cover with grease in housing cover.

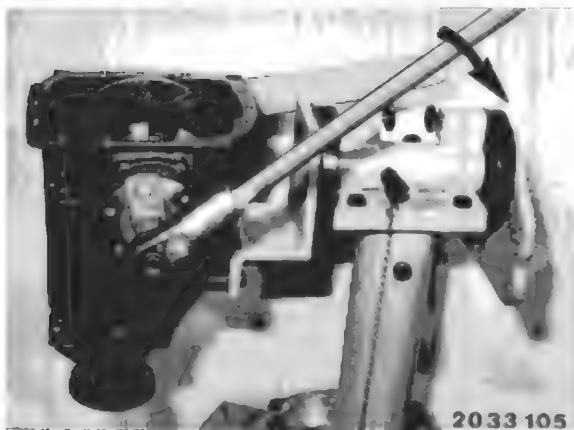


Fit housing cover with washers (do not allow lug disc to slide out of groove).

Install screws with Loctite No. 270 and tighten down cover evenly.

Installation:

For tightening torque, refer to Technical Data



Check slip torque, refer to Technical Data

of limited slip differential at (a) stationary and (b) driven differential side gear.

Make up tool locally for this purpose by, for example, welding a nut on a drive flange which is no longer required.

Note:

Replacement/repair

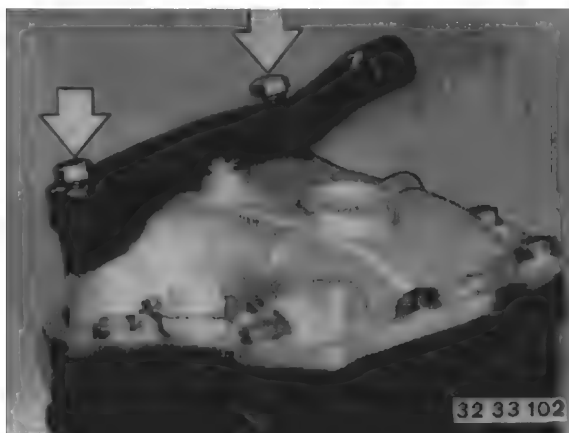
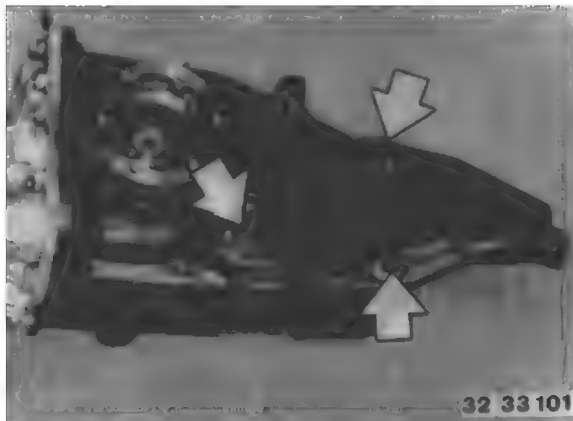
Unscrew front transmission suspension carrier plate.

Installation:

Mount carrier plate again after repairing.

Tightening Torque,

refer to Technical Data 33 17 5AZ.



Bracket for rear transmission suspension is mounted in the transmission cover with both long bolts.

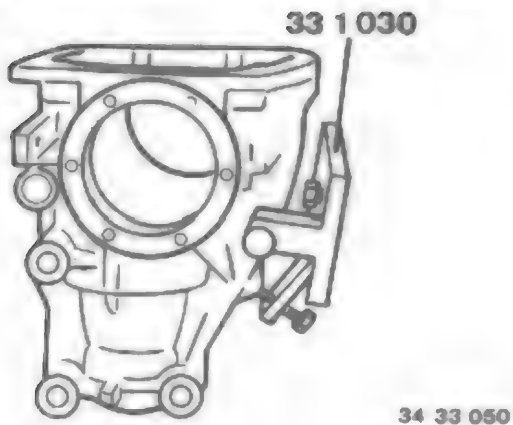
Installation:

Secure bracket to cover.

Tightening Torque,

refer to Technical Data 33 17 5AZ.

Locate final drive in assembly frame with special tool 33 1 010/030 (locating bracket).

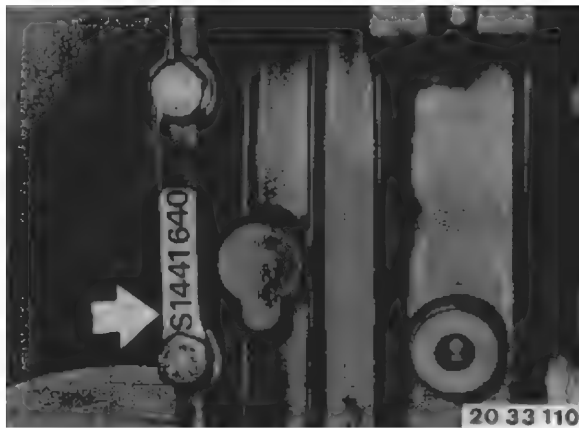


Model series	Engine/displacement	Final drive	Remark
E36	M41, M42, M43, M44, M50 B20, M52 B20, CNG (gas)	168N	
E36/7	M43 B18/B19, M44 B19, M52 B20	168N	From 1.04.98 these cars with sports suspension are equipped with the 188N final drive with Torsen differential lock
E36	M50 B25, M51, M52 B23/B28	188N	
	S50	210	with differential lock
E36/7	M52 B25/B28, M54	188N	
E36/7	S54	188	with differential lock
E38	M52, M51, M62 B35	188K	
	M62 B40, M57, M67, M73	220K	
E39	M52, M57 B25, M62 B35	188K	
	S62	215	with differential lock
	M57 B30, M62 B40	220K	
E46	M43, M52 B20, M54 B22 A	168K	
	M52 B23/B28, M54 B22/B30, M47, M57 B25	188K	
	S54	210	with variable M differential lock
	M57 B30	215K	
E46/16	M54, M57	188K	
E52	S62	220K	
E53	M54, M57, M62	188K	

N => normal drive

K => compact drive

The limited-slip differential is designated on the housing or on the type plate with an "S".



A limited-slip differential has the following advantages:

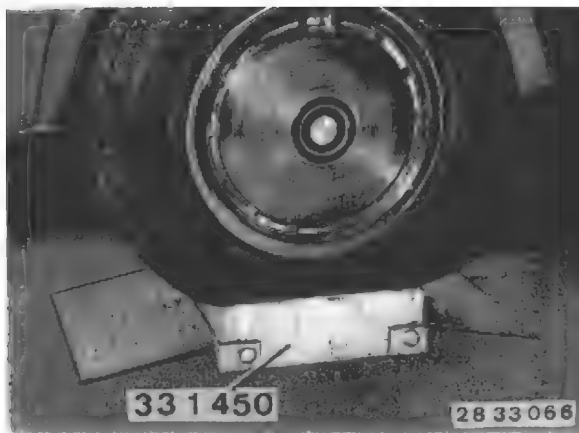
- Wheel slip when leaving the ground while driving over uneven ground is prevented.
- With varying levels of traction / grip, wheel slip is prevented when setting off.
- When cornering at high speed, the nearside wheel does not spin.
- The wheels do not spin on wet surfaces and at high roadspeeds.
- The risk of slipping at high speed on variable road surfaces is reduced substantially.

Function check while installed:

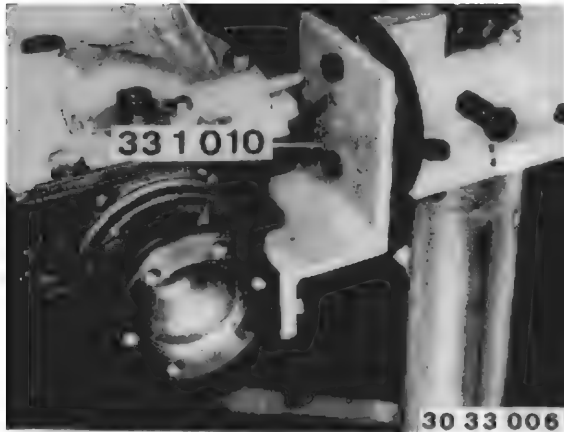
- Flat workshop floor.
- Drive left wheel of vehicle onto special tool 33 1 450.
- Fully release handbrake.
- Engage 1st gear and run engine up to speed.
- The limited-slip differential is functioning correctly if the vehicle can be driven off the special tool 33 1 450.

Caution!

Slowly drive out of the fixture.



Remove final drive,
refer to 33 10 010.



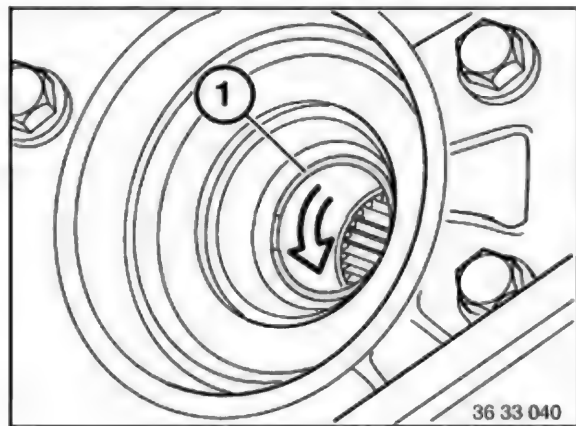
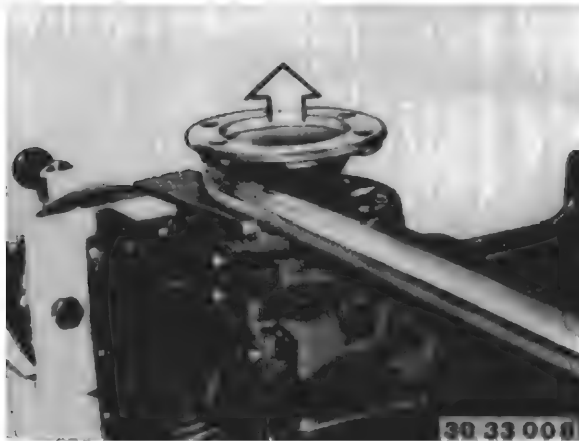
Secure final drive to special tool 33 1 010.
Drain off fluid.
Take off case cover.

Installation:

Replace seal. Tightening Torque,
refer to Technical Data 33 11 1AZ.

Topping up oil. Oil fill quantity,
refer to Technical Data.
Oil grades,
refer to BMW Service Operating Fluids.

Press off drive flange with pry bar.



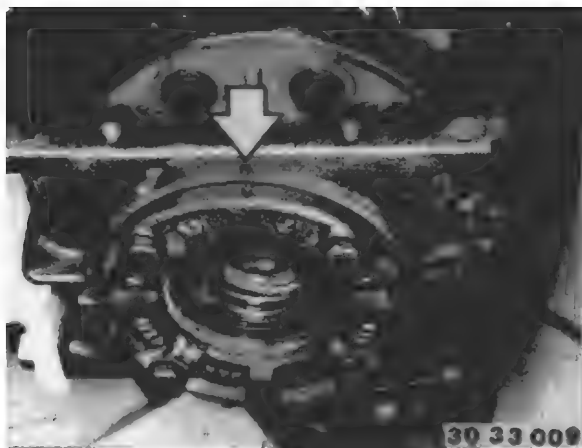
Installation:

Before fitting the drive flange, the round wire circlip (1) must
be placed in the groove of the differential housing in such a
way that both ends of the round wire circlip are recessed.

This prevents lateral bending of the ring.

Press in drive flange by hand and turn slightly until wire snap ring
is heard to engage.

Replace stretched snap rings.



Punch mark both bearing caps.

Unfasten screws on both bearing covers and remove bearing covers (turn if necessary, because the sealing ring grips firmly - suction).

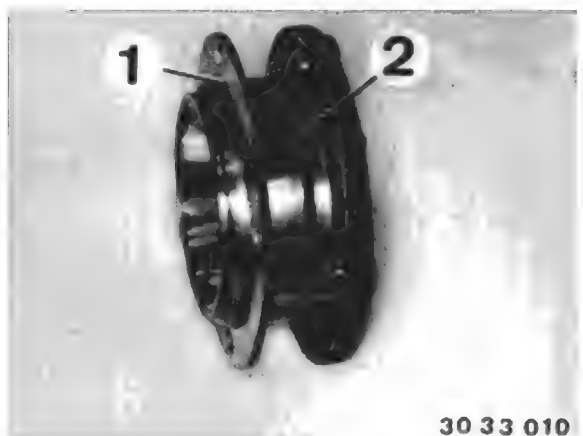
Caution!

Do not mix up bearing caps and spacers.

Secure spacers on bearing cap with a piece of wire, if necessary.

Installation:

Tightening Torque,
refer to Technical Data 33 11 2AZ.



With shims (1), the axial preload of the differential bearing (4000 N) and the torsional face runout of the crown and bevel gear is set.

(2) = O-ring



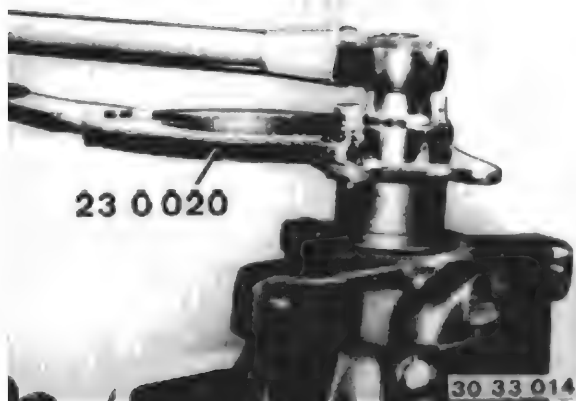
Remove complete differential case.

Caution!

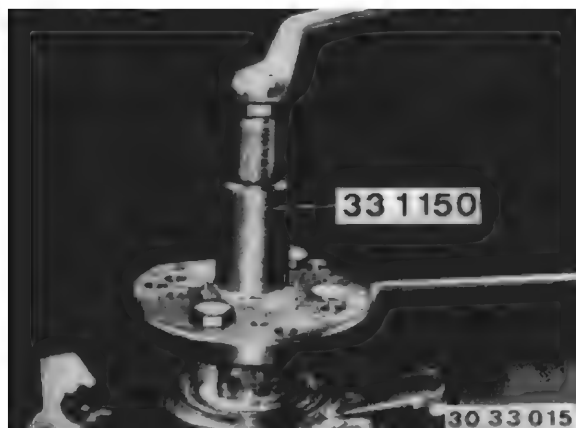
Do not bend the pulse generator wheel.



Remove lockplate.



Brace input flange with special tool 23 0 020 and unfasten collar nut.

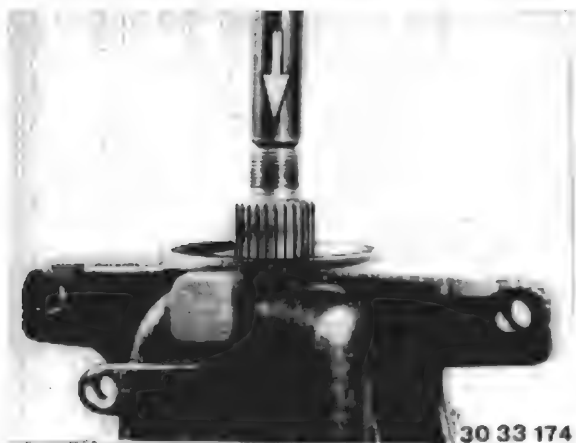


Remove input flange with special tool 33 1 150.

The specified friction torque level is indicated for the new bearing,

refer to Technical Data.

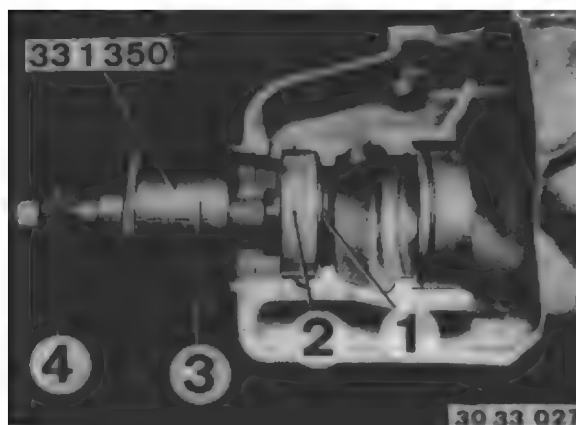
The friction torque of the old bearings no longer needs to be measured.



Press out drive pinion.

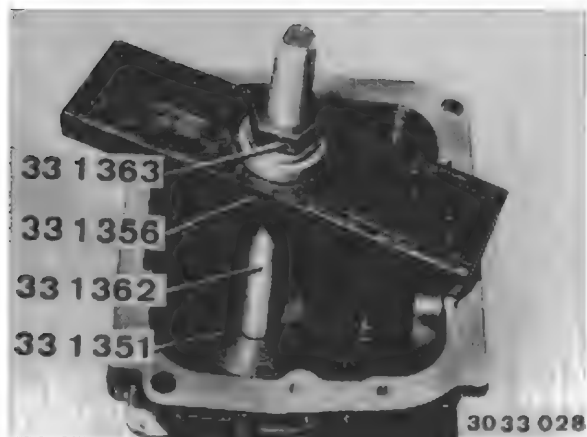
Caution!

Be careful not to damage threads.



Extract front outer bearing race with special tool 33 1 350.

- (1) = Spreader
- (2) = Outer bearing race front
- (3) = Puller bell housing
- (4) = Pressure bolt



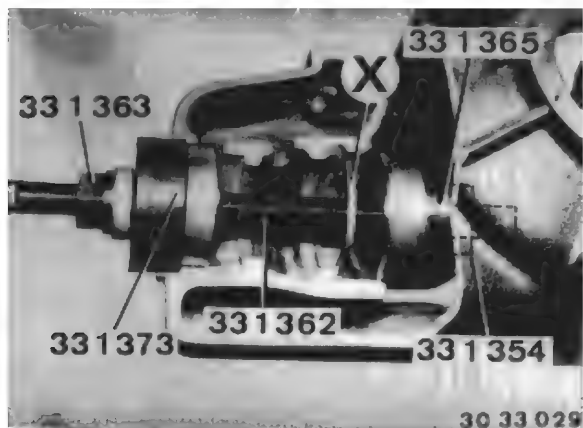
Remove rear outer bearing race with special tool 33 1 351 / 356 / 362 / 363.

Caution!

The shim (X) is located below the rear outer bearing race.

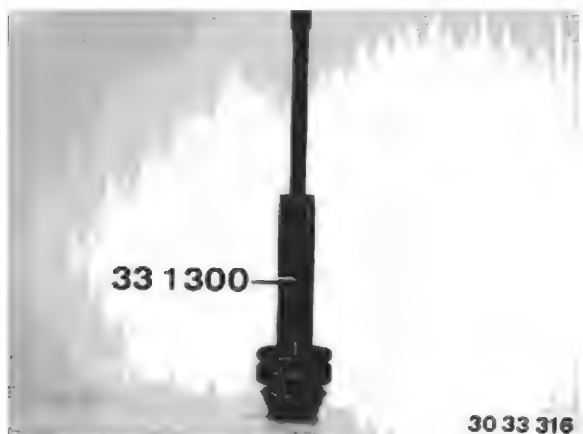
This is needed again to adjust the block dimension.

Measure and note down thickness of shim (X) e.g. X = 4.10 mm.

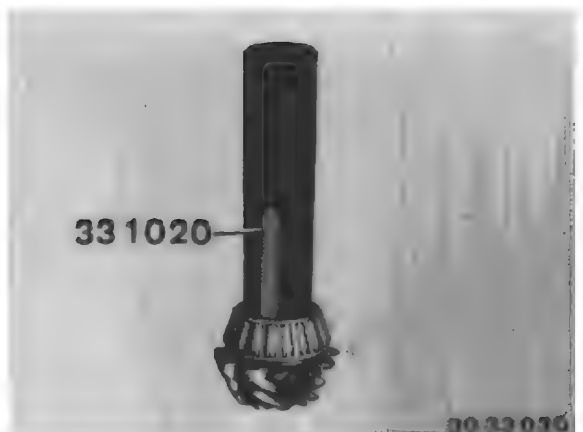


Install old shim (X) in front of rear outer bearing race.

Draw in new outer bearing races with special tool 33 1 373 / 365 / 362 / 363 / 354.



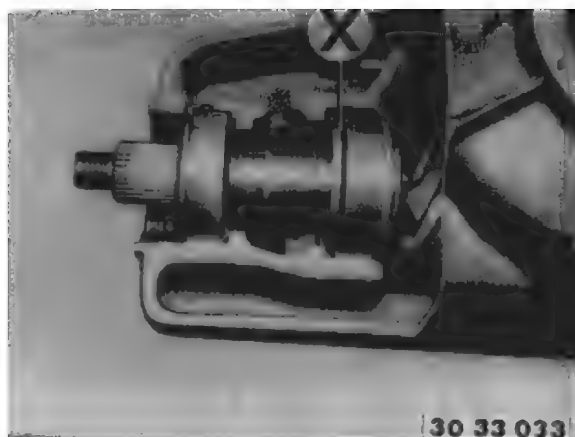
Pull bevel gear roller bearings off drive pinion with special tool 33 1 300.



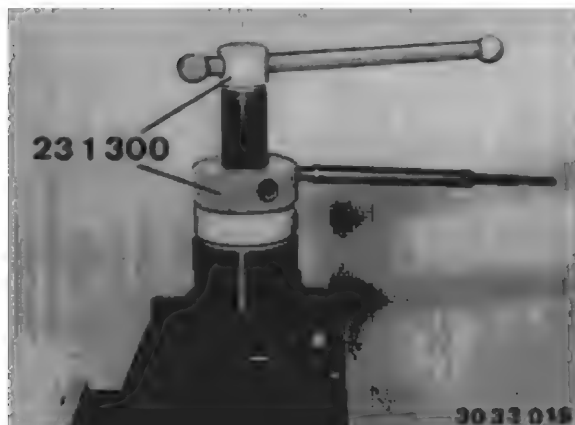
Press new taper roller bearing onto drive pinion using special tool 33 1 020.

Caution!

Always only use same make bearings for both.



To determine the correct shim (X), the drive pinion is installed with new taper roller bearings and no clamping bush.



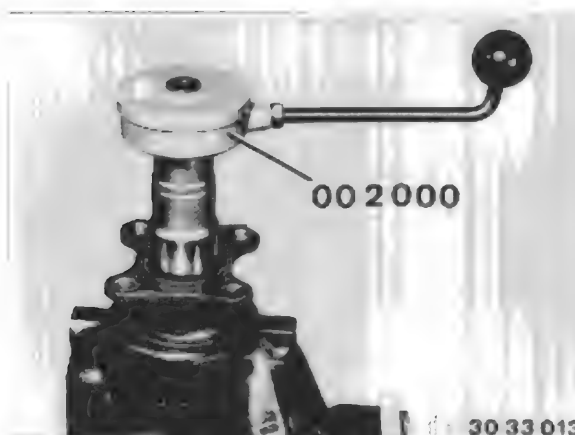
Install drive pinion in the rear bearing outer race.

Draw front taper roller bearing onto drive pinion with special tool 23 1 300 in conjunction with a spacer bush.



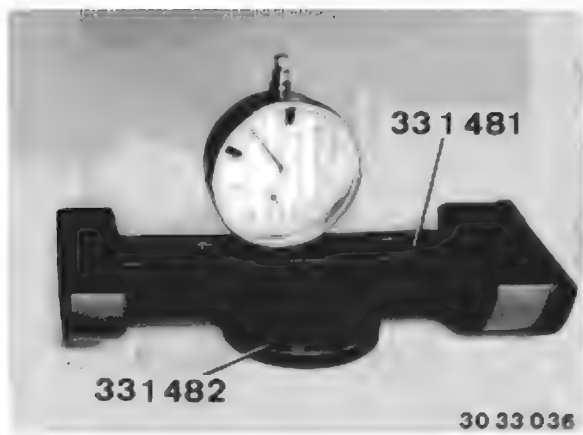
Mount input flange.

By carefully tightening down the collar nut, adjust friction torque of input taper roller bearing to 250 Ncm.



Caution!

When tightening down, keep checking friction torque with special tool 00 2 000 at regular intervals.



Secure dial gauge in special tool 33 1 481.

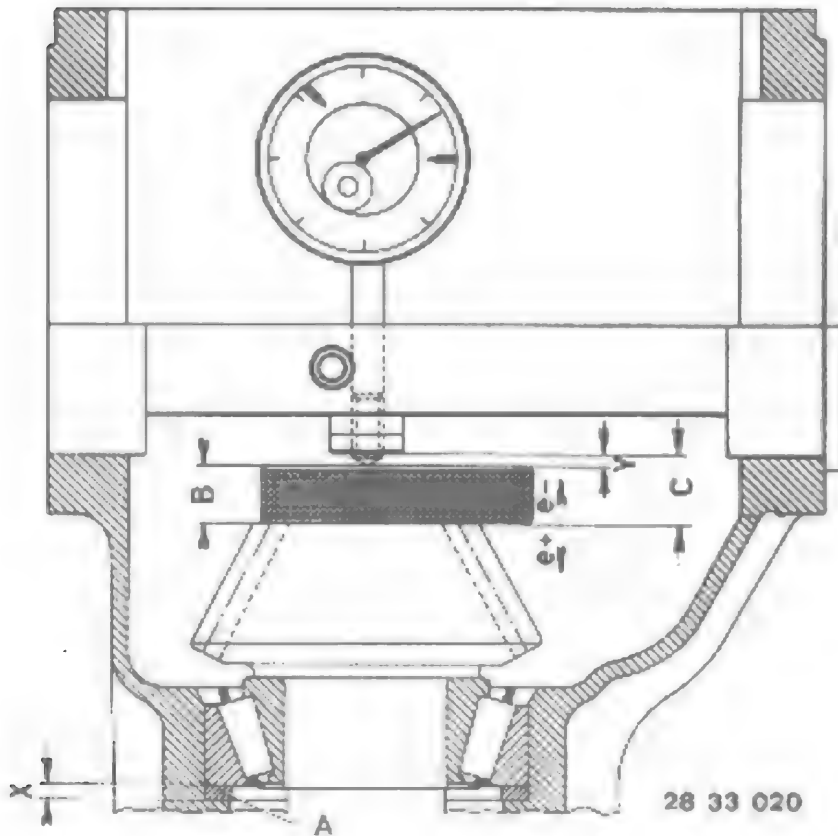
Fit special tool 33 1 481 with dial gauge on special tool 33 1 482 and set dial gauge preload to zero.

Fitting special tool 33 1 482 to drive pinion.

Install special tool 33 1 481 in housing.

Read value (Y) and note down e.g. Y = 1.92 mm.

Example:



C = 9.02 mm (basic adjustment dimension for all Type K final drives)

B = 7.00 mm (special tool 33 1 482)

- / +e = number from taper e.g. +e 10

Y = measured distance e.g. 1.92 mm

X = old shim e.g. 4.10 mm

A = Thickness of correct shim

Determination of correct shim:

C nominal = C + e = 9.02 mm + 0.10 mm = 9.12 mm

C actual = B + Y = 7.00 mm + 1.92 mm = 8.92 mm

D (difference) = C nominal - C actual = 9.02 mm - 8.92 mm = +0.20 mm

A = X - D = 4.10 mm - (+0.20 mm) = 3.90 mm

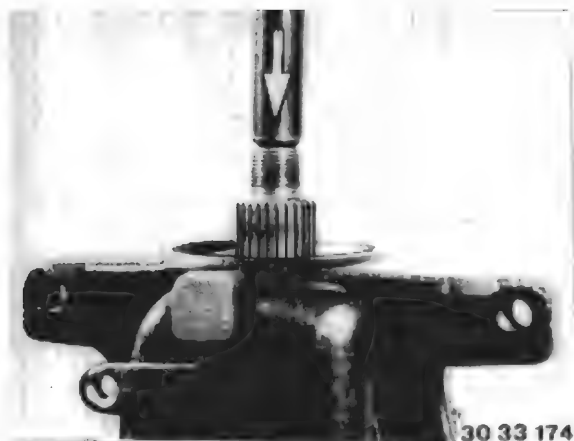
The correct thickness for the shim is 3.90 mm.

Caution!

If the difference (D) is positive, the old shim was this much too thick.

If the difference (D) is negative, the old shim was this much too thin.

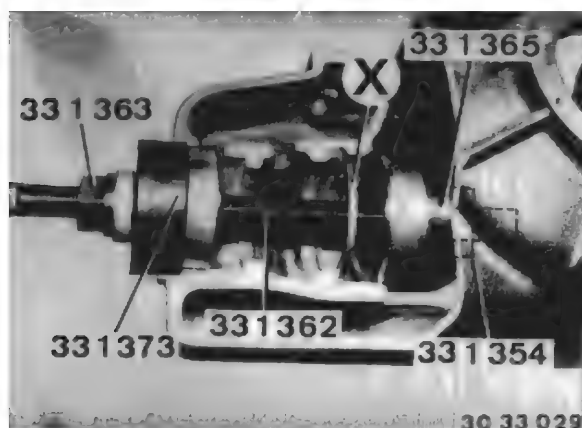
The permitted tolerance for the shim (A) is derived from the available shim gauges which range from 0.01 ... 0.03 mm.



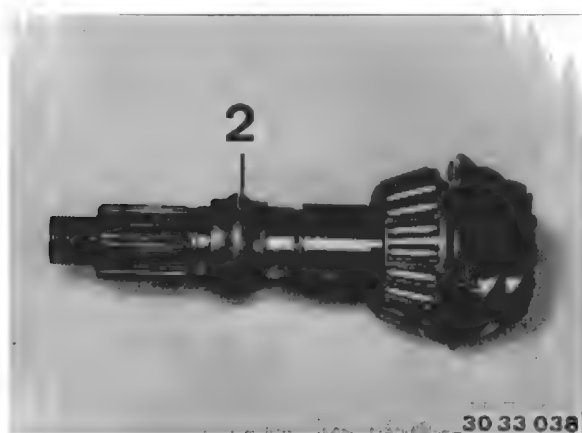
After determining the shim thickness (x), remove drive pinion.

Caution!

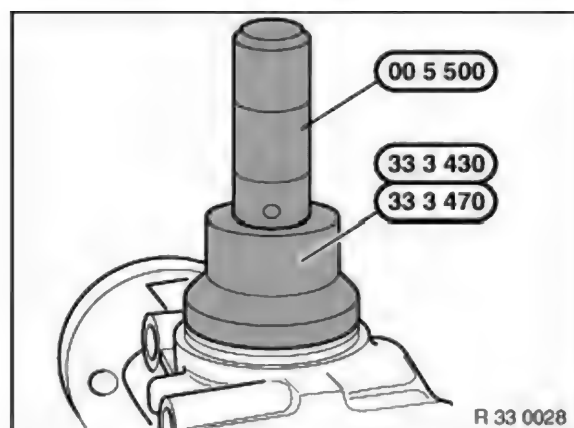
Note make of bearings - this is required to determine the friction torque.



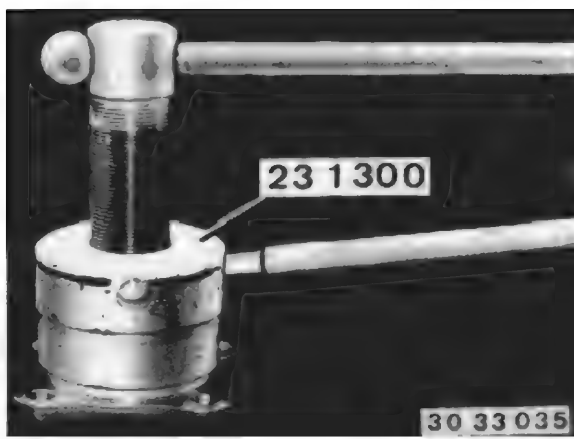
Remove rear outer bearing race and install with a shim (x) of the appropriate thickness.



Install drive pinion with a new clamping sleeve (2).

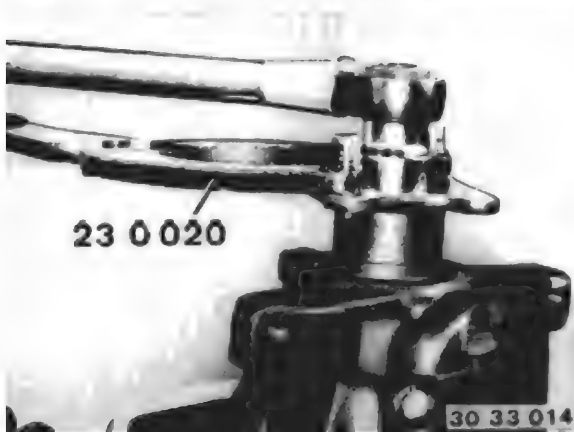


Immerse shaft seal in final drive oil and drive in flush with special tool 33 1 430 in conjunction with special tool 00 5 500.

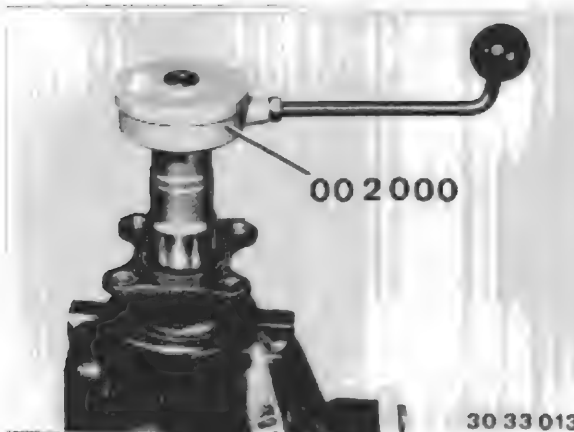


Press-fit input flange to the input shaft using special tool 23 1 300 but do not tighten down.

The axial preload force of drive pinion bearings (5000 N) can be determined with help of the friction torque.



Gradually tighten down input flange with collar nut, measuring friction torque at regular intervals.



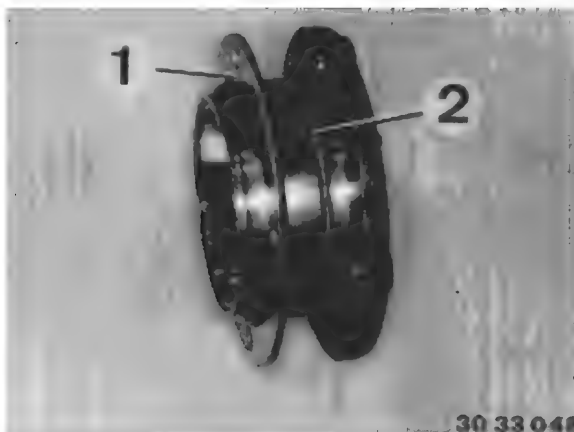
Measure friction torque with special tool 00 2 000 and suitable socket adapter.

refer to Technical Data.

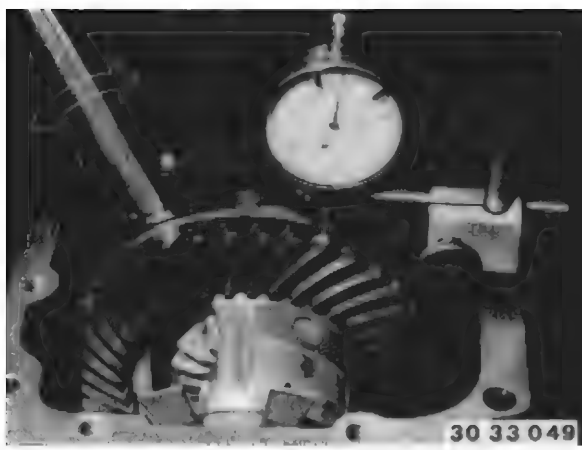
Caution!

The relation between friction torque and preload force differs depending on the make of bearings.

Refer to pinion bearing table for specified friction torque, refer to Technical Data, and add 20 Ncm for the new shaft seal.



Install final drive, install side cover after marking with the appropriate washers (1) and install new O-rings (2). Tighten screws down evenly. Tightening Torque, refer to Technical Data 33 11 2AZ.



Backlash/Tooth Contact Pattern Adjustment

Secure special tool 00 2 500 (dial gauge holder) and measure torsional face runout, refer to Technical Data.

Caution!

The tooth contact pattern is always most important for a perfectly adjusted pinion/crown wheel.



To check the tooth contact pattern, coat the crown wheel teeth with printer's ink, turn in both directions several times and stop crown wheel suddenly with a piece of hard wood.



Correction to torsional face runout and contact pattern is performed by altering the thicknesses of both shims (1).

If backlash is too great, install a thinner shim on the crown wheel end.

If backlash is too small, use a thicker shim on the crown wheel end.

Axial displacement of the crown wheel of 0.01 mm signifies a change in tooth flank clearance of 0.0076 mm.

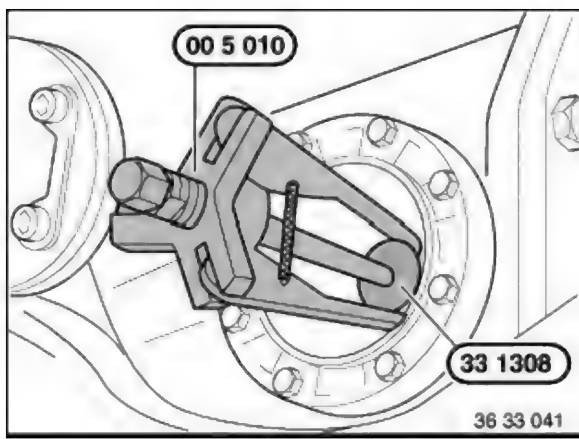
Caution!

The total of both shim thicknesses must not be altered.

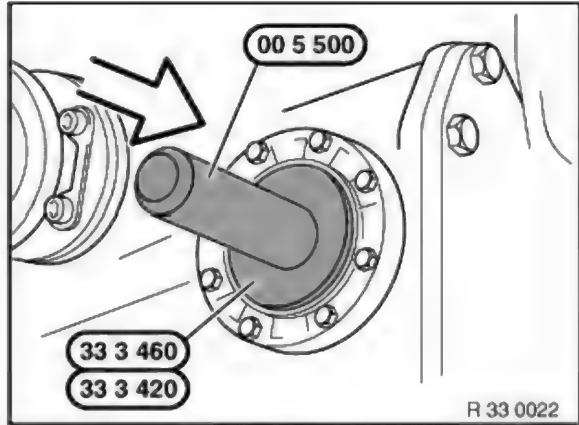
If a thicker or thinner shim to those fitted is required to adjust the contact pattern, the overall thickness must be re-established with a second shim. Failure to do this would alter the friction torque of the bearing.

Determining friction torque of differential bearings, refer to Replacing differential bearings, refer to 33 11 731.

Tooth contact pattern adjustment, refer to 33 12 ... Basic rules for tooth contact pattern adjustment.



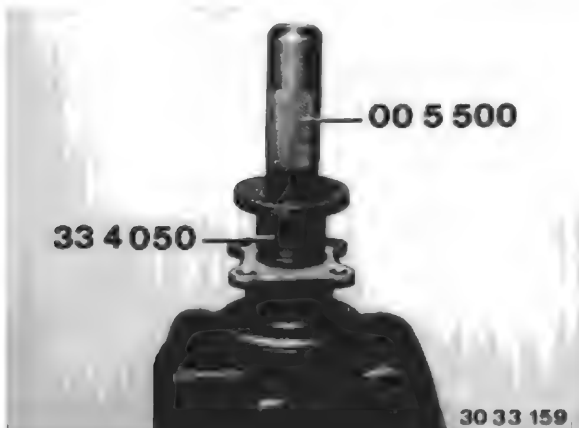
Extract old shaft seal with special tool 00 5 010 in conjunction with pressure piece.



Dip new shaft seals in final drive gear lube.

Drive in shaft seals with special tool 33 3 460 (impact bush) in conjunction with special tool 00 5 500 up to stop.

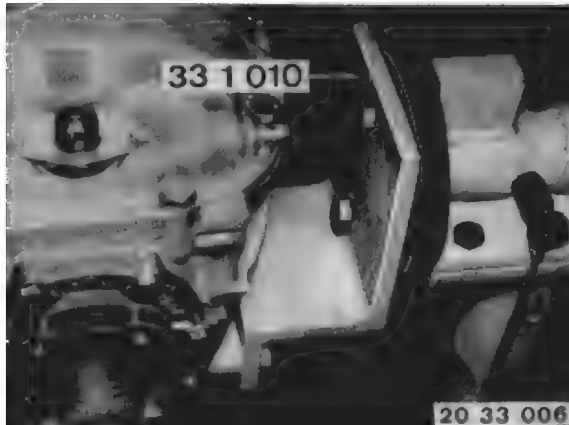
Replace drive flange if the bearing surface is seriously scored.



Installation:

Drive in new retaining plate with special tool 33 4 050 and special tool 00 5 500 (handle).

Removing final drive, included in MF (microfiche) Repair Instructions, model-dependent, from '85, refer to 33 10 010.



Secure final drive to special tool 33 1 010.

Drain off fluid. Take off case cover.

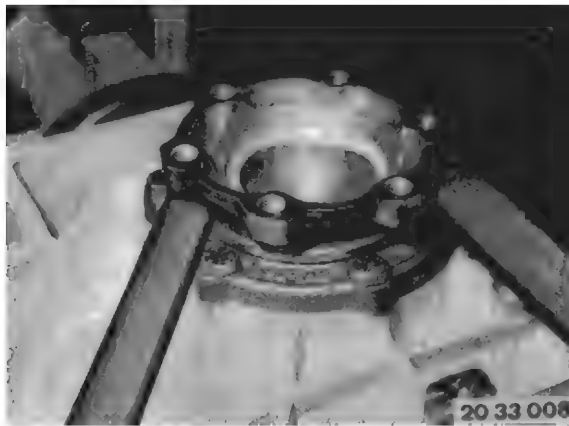
Installation:

Replace seal.

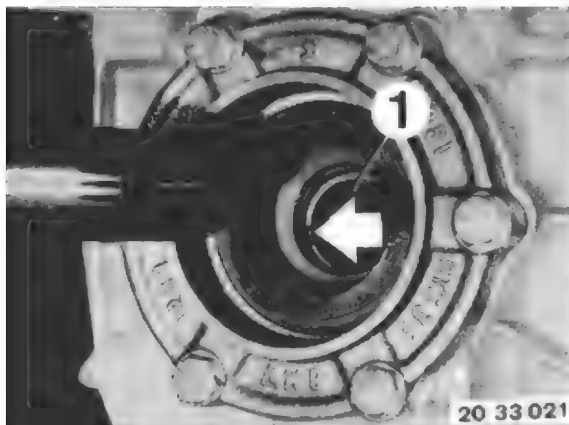
Tightening Torque,
refer to Technical Data 33 11 1AZ.

Topping up oil,
Oil quantity,
refer to Technical Data.

Oil grades,
refer to Operating Fluids specifications.



Press off drive flange with pry bar.



Installation:

Before fitting the drive flange, the round wire circlip (1) must be placed in the groove of the differential housing in such a way that both ends of the round wire circlip are recessed.

This prevents lateral bending of the ring.

Press in drive flange by hand and turn slightly until wire snap ring is heard to engage.

Replace stretched snap rings.



Punch mark both bearing caps.

Unfasten screws on both bearing covers and remove bearing covers (turn if necessary, because the sealing ring grips firmly - suction).

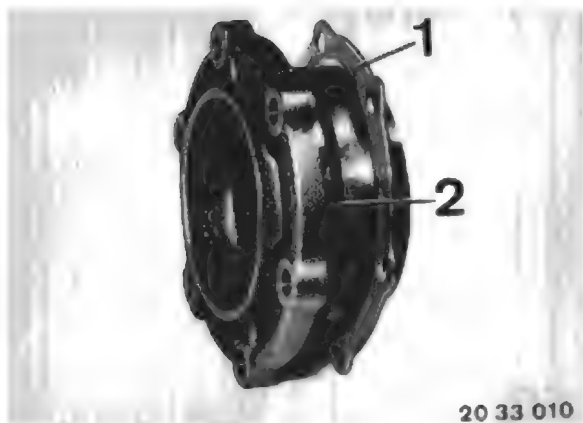
Caution!

Do not mix up bearing caps and spacers.

Secure spacers on bearing cap with a piece of wire, if necessary.

Installation:

Tightening Torque,
refer to Technical Data 33 11 2AZ.



Shims (1) are used to adjust axial preload force of final drive mounting (4000 N) and torsional face runout of crown wheel and bevel gear.

(2) O-ring



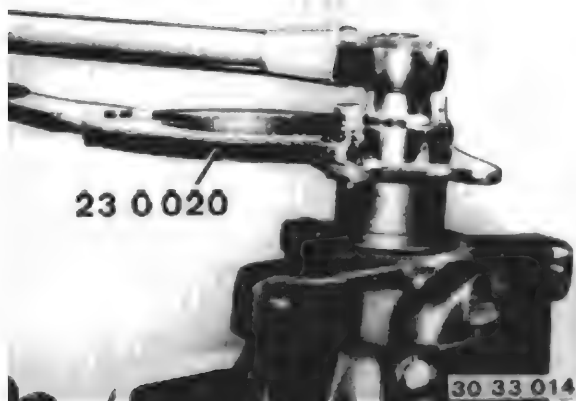
Remove complete differential case.

Caution!

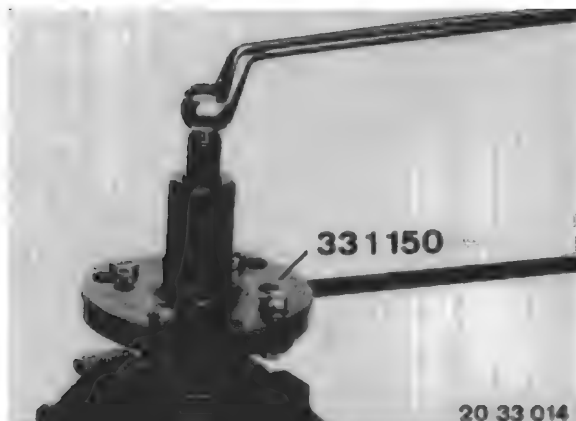
Do not bend the pulse generator wheel.



Lift out lockplate (1).



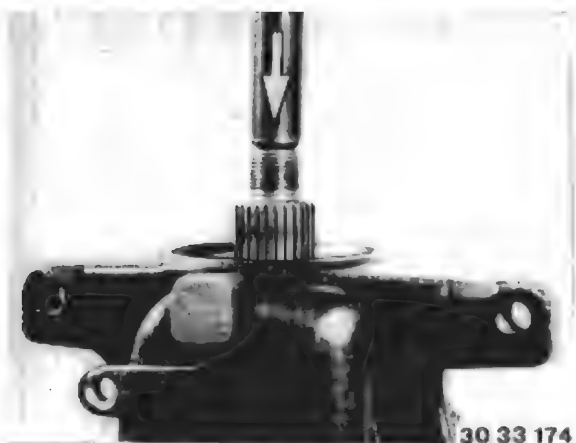
Brace input flange with special tool 23 0 020 and unfasten collar nut.



Remove input flange with special tool 33 1 150.

The specified friction torque level is indicated for the new bearings,
refer to Technical Data.

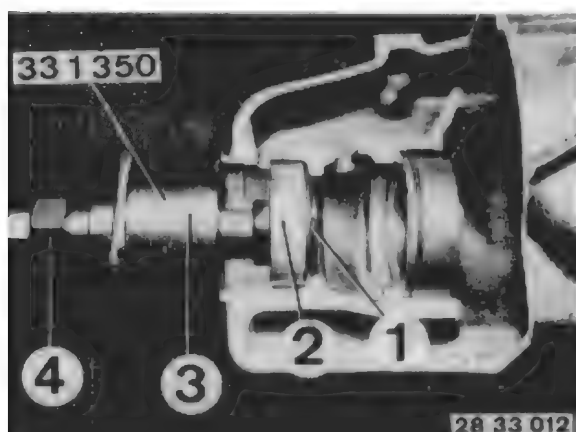
The friction torque of the old bearings no longer needs to be measured.



Press out drive pinion.

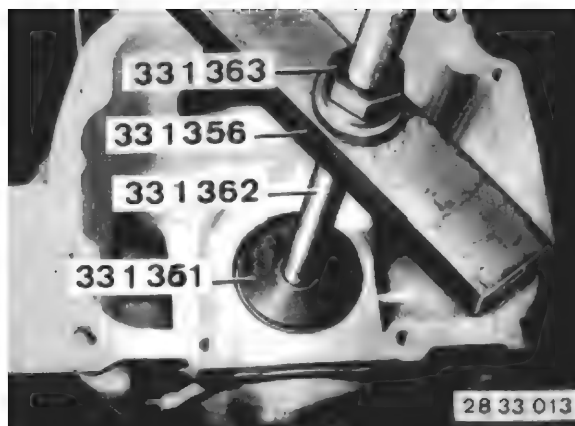
Caution!

Be careful not to damage threads.



Extract front outer bearing race with special tool 33 1 350.

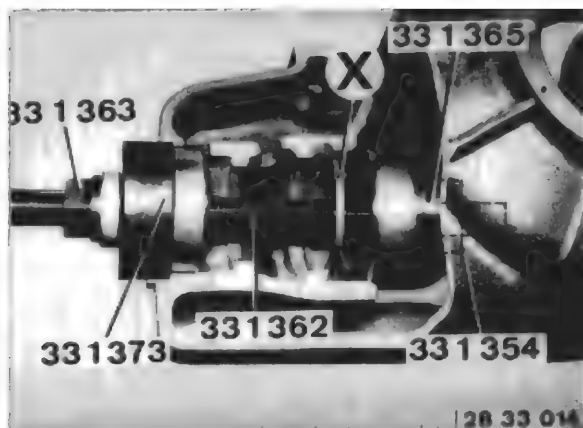
- (1) Spreader
- (2) Front bearing outer race
- (3) Puller bell housing
- (4) Pressure bolt



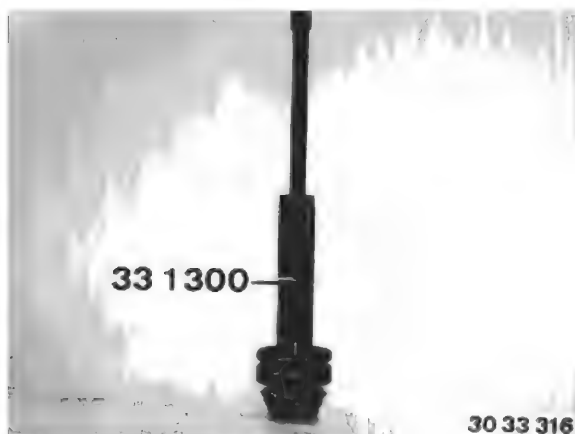
Remove rear outer bearing race with special tool 33 1 360 / 361 / 362 / 363 / 356.

Caution!

Shim (X) is located underneath the rear bearing outer race.
This is needed again to adjust the block dimension.



Install old shim (X) in front of the rear bearing outer race.
Draw in outer bearing races with special tool 33 1 360 / 362 / 363 / 365 / 354 / 373.



Pull bevel gear roller bearings off drive pinion with special tool 33 1 300.

Caution!

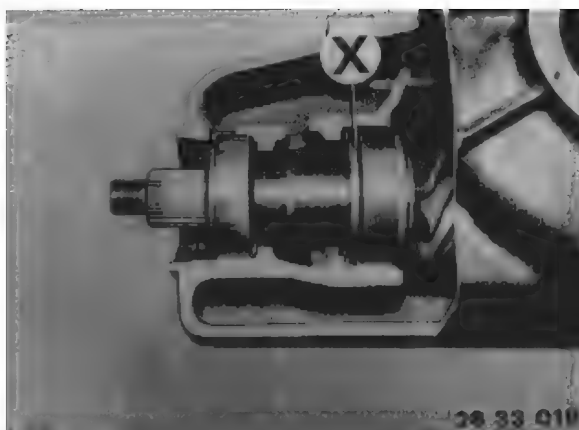
Do not damage taper: Insert aluminium jaws or wooden blocks.



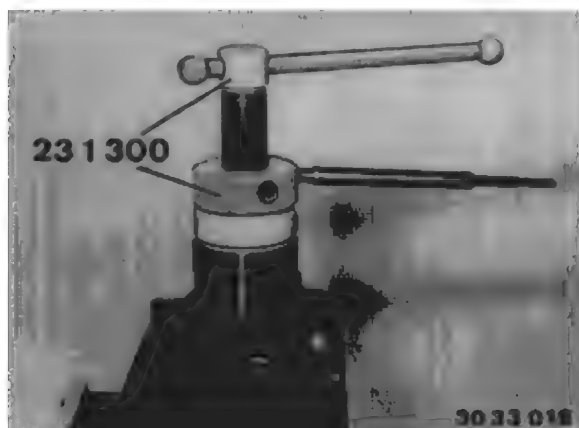
Press-fit new taper roller bearing to the drive pinion with special tool 33 1 020 (sleeve).

Caution!

Always only use same make bearings for both.



Install the drive pinion with new tapered roller bearings, but without a clamping sleeve, to determine the correct thickness of shim (X).



Install drive pinion in the rear bearing outer race.
Pull front taper roller bearing onto the drive pinion with special tool 23 1 300 in conjunction with a spacer bush.

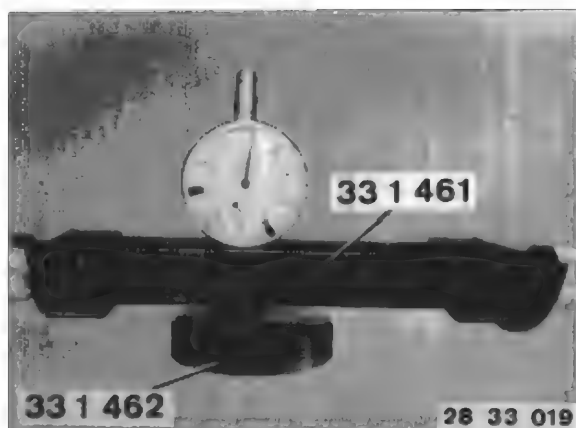


Mount input flange.
By carefully tightening down the collar nut, adjust friction torque of input taper roller bearing to 250 Ncm.



Caution!

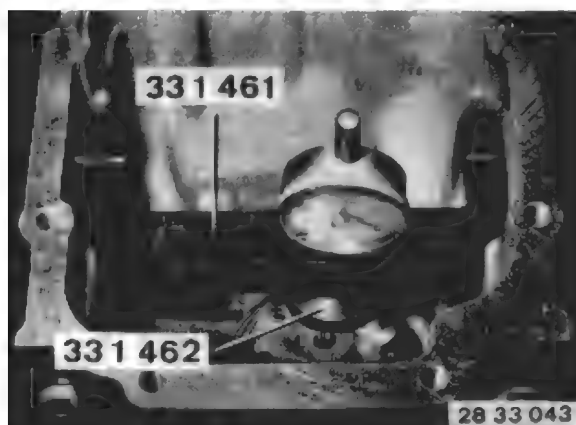
When tightening down, keep checking friction torque with special tool 00 2 000 at regular intervals.



Block Distance of Drive Pinion

Secure dial gauge in special tool 33 1 461.

Fit special tool 33 1 461 with dial gauge on special tool 33 1 462 and set dial gauge preload to zero.



Fit special tool 33 1 462 to drive pinion.

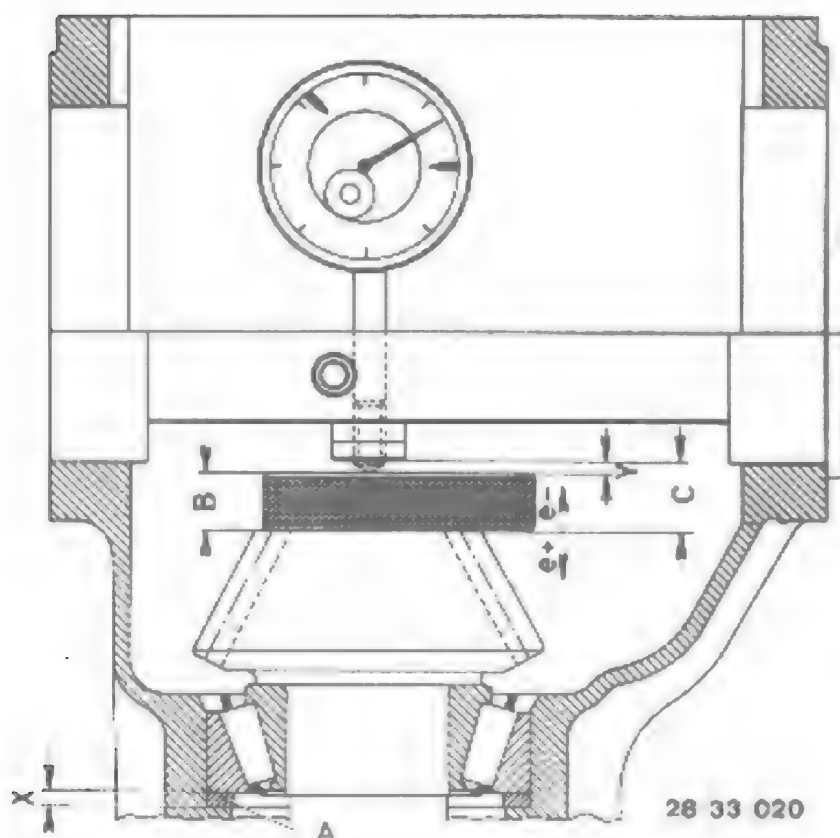
Install special tool 33 1 461 in housing.

Determine value Y:

Basic distance C = 11.50 mm

Gage thickness B = 9.50 mm

Examples for Determination of Correct Shim Thickness (X)



Example I:

C	11.50 mm
e +	0.10 mm
C nominal	11.60 mm

Y measured on dial gage	1.90 mm
+ gage thickness B	9.50 mm
C actual	11.40 mm

C nominal	11.60 mm
C actual	- 11.40 mm
a	0.20 mm
Master disc A	4.10 mm
- a	0.20 mm
Thickness of shim (X)	3.90 mm

If C nominal is greater than C actual, "a" is subtracted from

thickness of shim (X).

Example II:

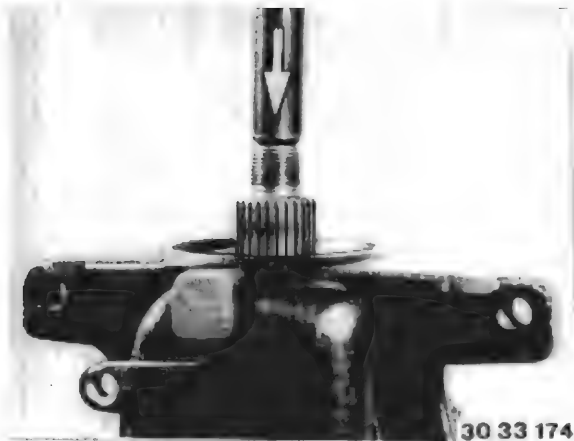
C	11.50 mm
e -	0.10 mm
C nominal	11.40 mm

Y measured on dial gage	2.20 mm
+ master disc thickness	9.50 mm
C actual	11.70 mm

C nominal	11.70 mm
C actual	- 11.50 mm
a	0.20 mm
Master disc A	3.90 mm
- a	0.20 mm
Thickness of shim (X)	4.10 mm

If C nominal is less than C actual, "a" on the shim ring (x) is added to the value.

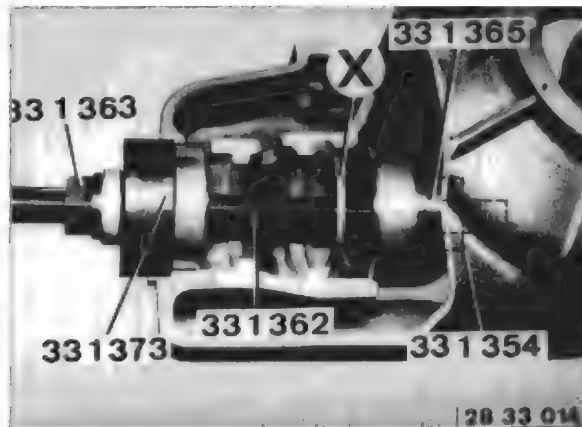
The permitted tolerance for dimension (x) is derived from the gage steps available for shim rings (0.01 ... 0.03 mm).



After determining the shim thickness (x), remove drive pinion.

Caution!

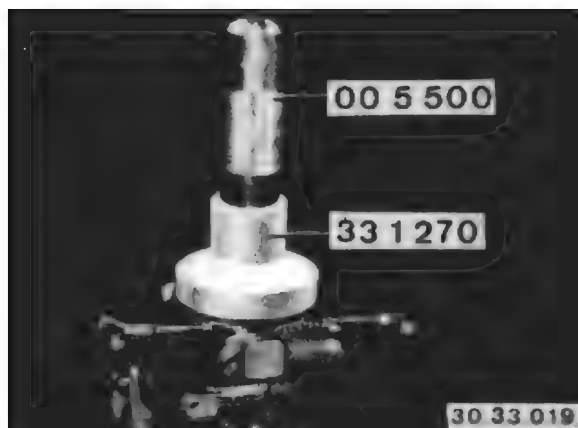
Note make of bearings - this is required to determine the friction torque.



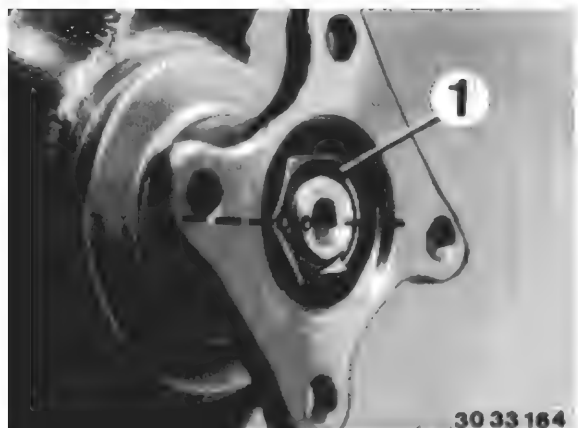
Remove rear outer bearing race and install with a shim (x) of the appropriate thickness.



Install drive pinion with a new clamping sleeve (2).



Immerse shaft seal in final drive oil and drive in flush with special tool 33 1 270 in conjunction with special tool 00 5 500.

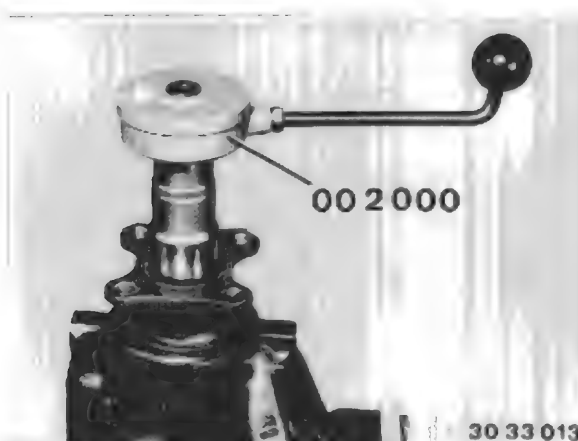


Press-fit input flange to the input shaft using special tool 23 1 300 but do not tighten down.

The axial preload force of drive pinion bearings (5000 N) can be determined with help of the friction torque.



Gradually tighten down input flange with collar nut, measuring friction torque at regular intervals.

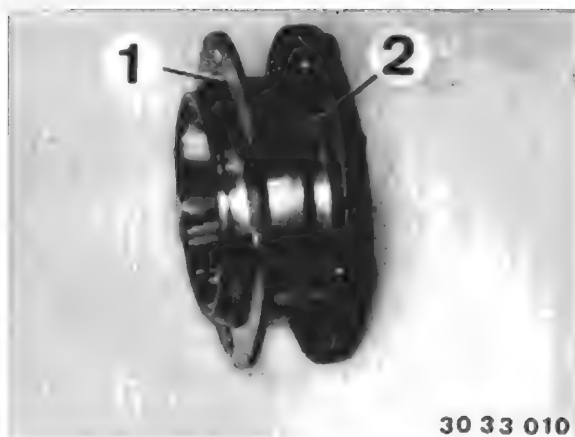


Measure friction torque with special tool 00 2 000 and suitable socket adapter, refer to Technical Data.

Caution!

The relation between friction torque and preload force differs depending on the make of bearings.

Refer to pinion bearing table for specified friction torque, refer to Technical Data, and add 20 Ncm for the new shaft seal.



Install final drive, install side cover after marking with the appropriate washers (1) and install new O-rings (2). Tighten screws down evenly.

Tightening Torque,
refer to Technical Data.



Backlash/tooth contact pattern adjustments

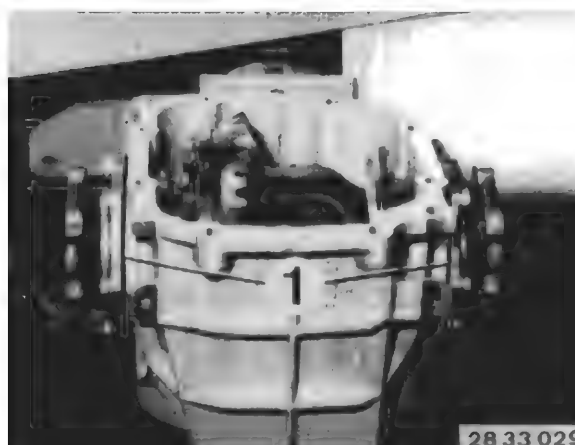
Secure special tool 00 2 500 (dial gauge holder) and measure torsional face runout,
refer to Technical Data.

Caution!

The tooth contact pattern is always most important for a perfectly adjusted pinion/crown wheel.



To check the tooth contact pattern, coat the crown wheel teeth with printer's ink, turn in both directions several times and stop crown wheel suddenly with a piece of hard wood.



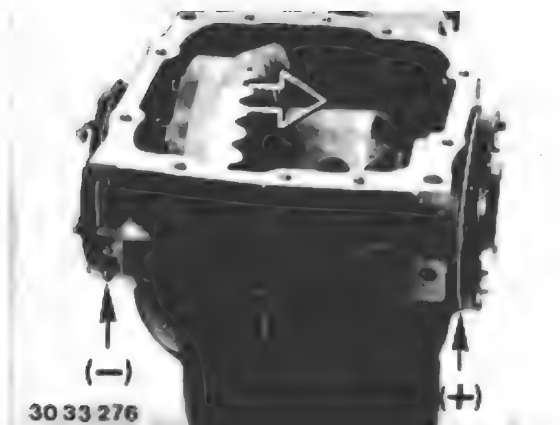
A correction to torsional face runout,
refer to Technical Data,

and contact pattern is performed by changing the thickness of both shims (1).

If backlash is too great, install a thinner shim on the crown wheel end.

If backlash is too small, use a thicker shim on the crown wheel end.

Axial displacement of the crown wheel of 0.01 mm signifies a change in tooth flank clearance of 0.0076 mm.



Caution!

The total of both shim thicknesses must not be altered.

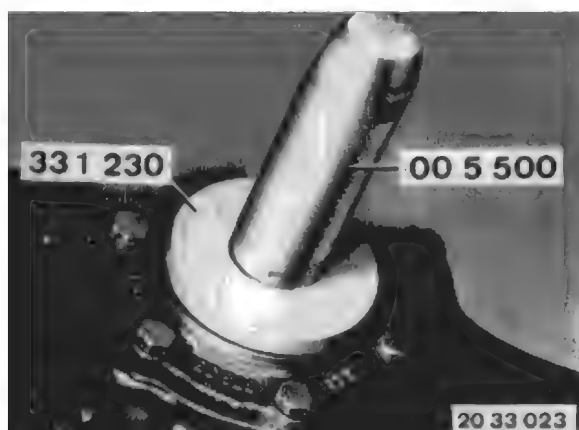
If a thicker or thinner shim is required on the one side to correct the tooth contact pattern, the other shim must also be changed again to have the original total thickness - if not, the friction torque of the bearings would be changed.

Determine friction torque differential bearings, described in Replace bearings for final drive housing, refer to 33 11 731.

Basic rules for contact pattern adjustment, as Replace drive pinion with crown wheel, refer to 33 12 ...



Extract old shaft seals with special tool 00 5 000 in conjunction with pressure piece.



Installation:

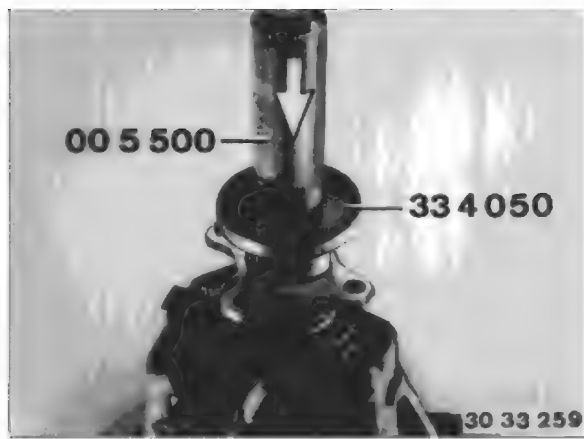
Dip new shaft seals in final drive gear lube.

Drive in shaft seals with special tool 33 1 230 in conjunction with special tool 00 5 500 up to stop.

Replace drive flange if the bearing surface is seriously scored.

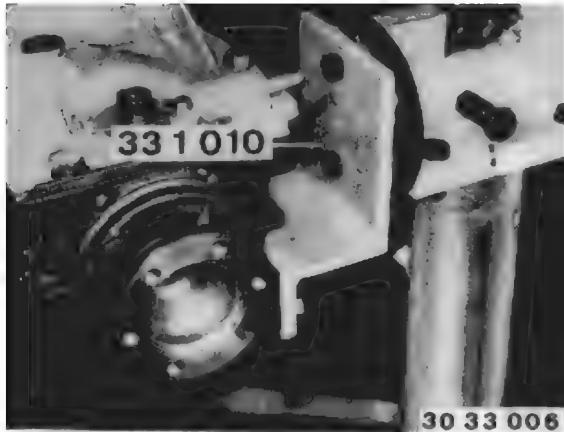
Note:

The special tool 33 1 230 may have to be remachined on account of the casting tolerances.



Drive in new retaining plate with special tool 33 4 050 and special tool 00 5 500.

Remove final drive,
refer to 33 10 010.

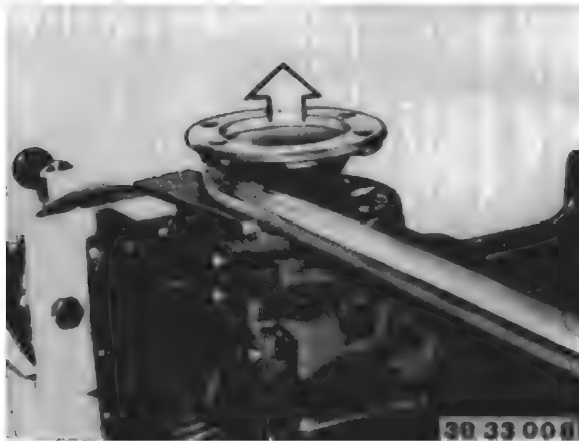


Secure final drive to special tool 33 1 010.
Drain off fluid.
Take off case cover.

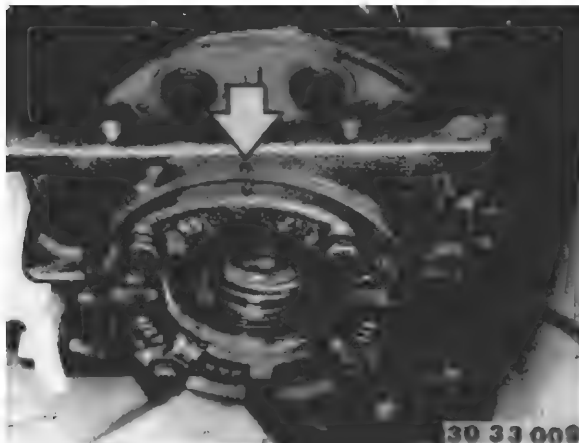
Installation:

Replace seal. Tightening Torque,
refer to Technical Data 33 11 1AZ.

Topping up oil. Oil quantity,
refer to Technical Data.
Oil grades,
refer to BMW Service Operating Fluids.



Press off drive flange with pry bar.



Mark bearing cap with punch marks and remove.

Caution!

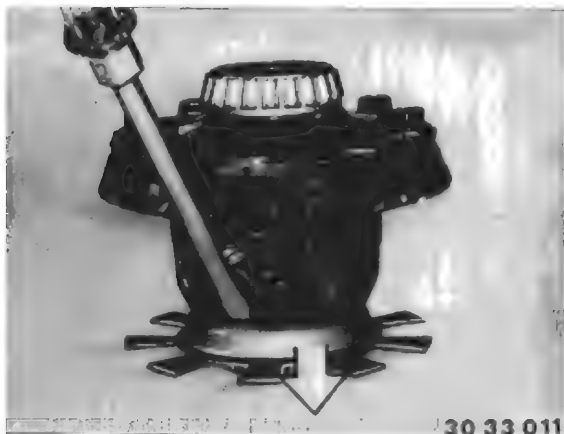
In order to make friction torque adjustments easier, ensure
that the bearing caps and spacer discs are not mixed up.



Remove complete differential case.

Caution!

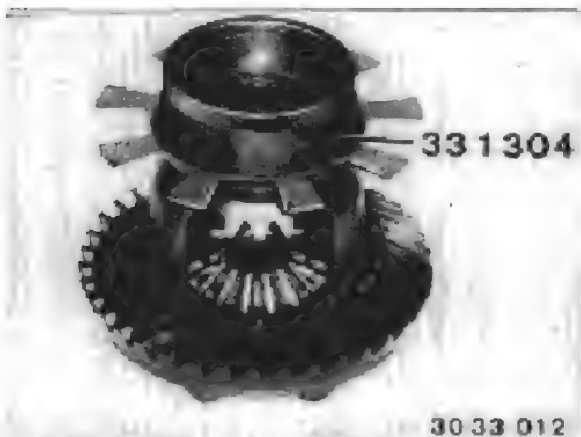
Do not bend the pulse generator wheel.



Press pulse generator wheel off of differential case.

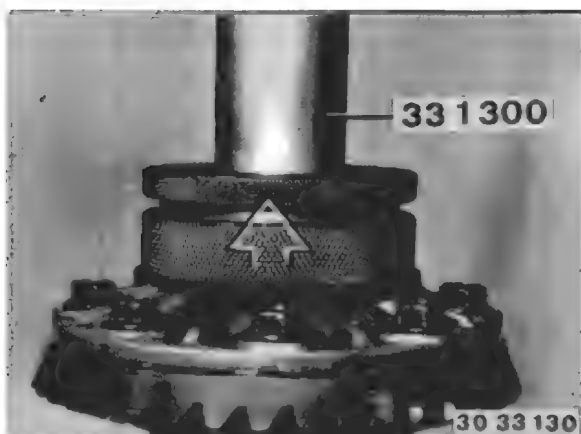
Caution!

Do not bend the pulse generator wheel.



Installation:

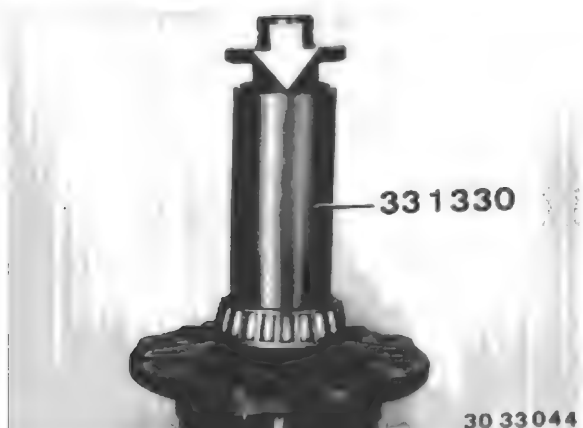
Press fit pulse alternator wheel using special tool 33 1 304.



Pull taper roller bearing off differential housing with special tool 33 1 300.



Remove crown wheel (cold).



Installation:

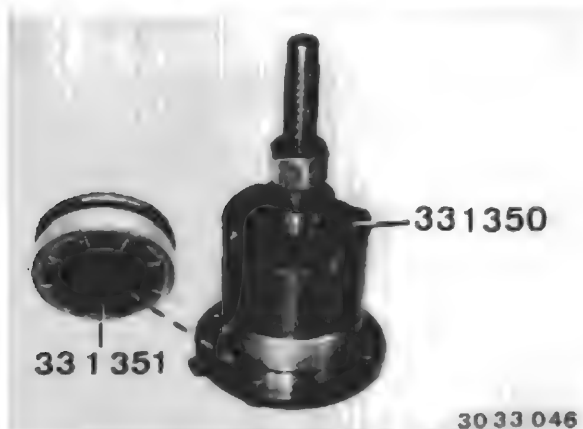
Cold-press new taper roller bearing on using special tool 33 1 330.

Caution!

Always only use same make bearings for both.



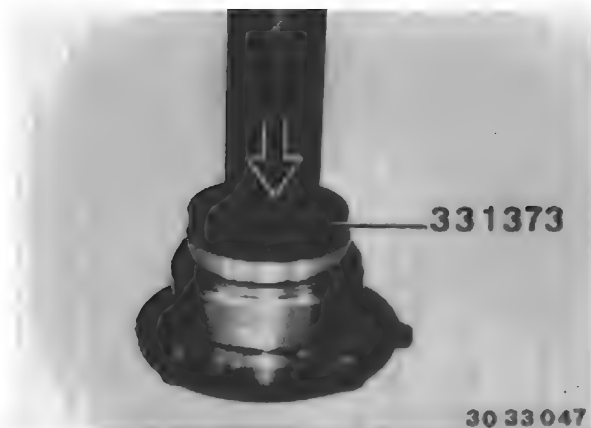
Lift shaft seals out of both bearing caps.



Press off outer bearing race with special tool 33 1 350 and special tool 33 1 351.

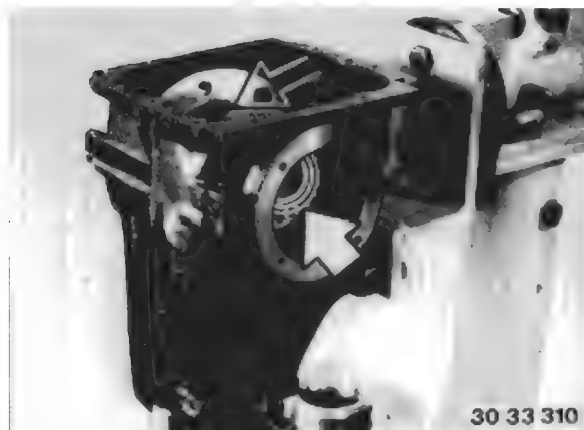
Caution!

Special tool 33 1 351 must engage in outer bearing race.



Installation:

Press new outer bearing race in with special tool 33 1 373.

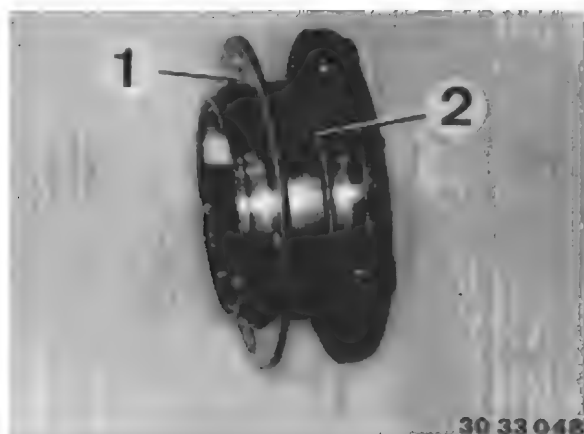


If only the differential bearings are being replaced, the drive pinion can remain installed and the differential case is installed without the ring gear for determination of shim thickness.

Caution!

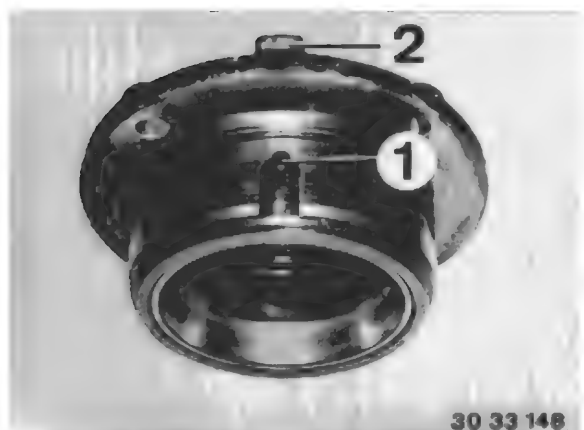
Note make of bearings - this is required to determine the friction torque.

Oil the new bearings well with differential oil, refer to BMW Service Operating Fluids, and allow to drip-drain.



Install side bearing caps marked with belonging shims (1), but at first without O-rings (2).

Tighten down bearing cover screws on bevel gear end evenly. Tightening Torque, refer to Technical Data 33 11 2AZ.



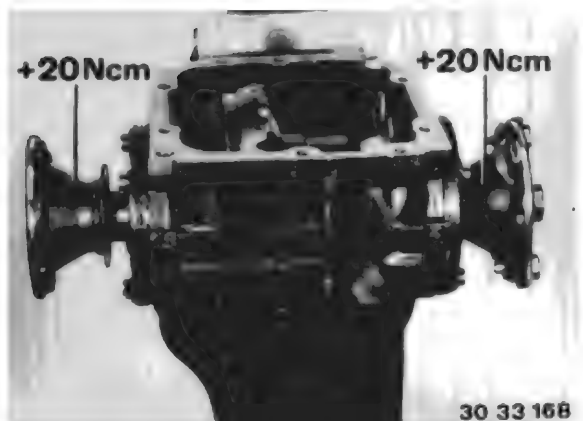
The lubricant bores (1) always face up when the transmission is installed correctly and this can be seen on the outside by way of tab (2).



30 33 311

The axial preload force of the differential housing bearing (4000 N) can be determined from the friction torque, refer to Technical Data 33 11 2AZ.

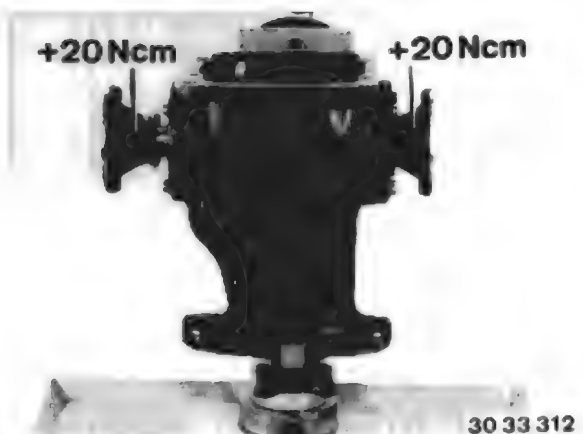
Tighten bolts of second bearing cap uniformly only enough, that the differential can still be turned easily.



30 33 168

On the side tightened down to Tightening Torque, install an output flange and determine friction torque by means of a bracket with welded nut (in-house manufacture) and special tool 00 2 000.

Turn friction torque meter at speed of approx. 50 rpm.



30 33 312

The friction torque level indicated in the final drive bearing table should be achieved, but should not be exceeded, refer to Technical Data.

If new shaft seals have already been installed, 20 Ncm must be added for each seal in which an output shaft runs while measuring.

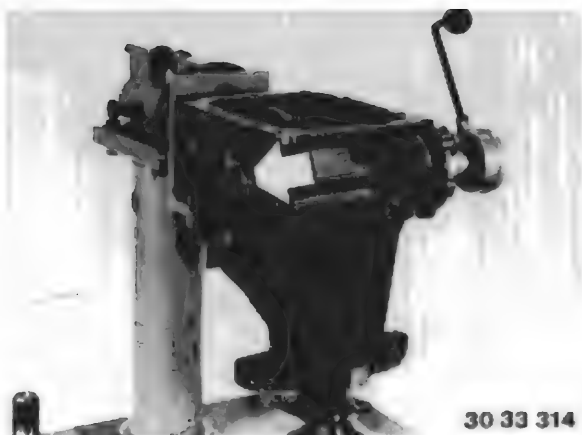


30 33 313

If the specified friction torque is not achieved, although both bearing covers are tightened down to specified Tightening Torque,

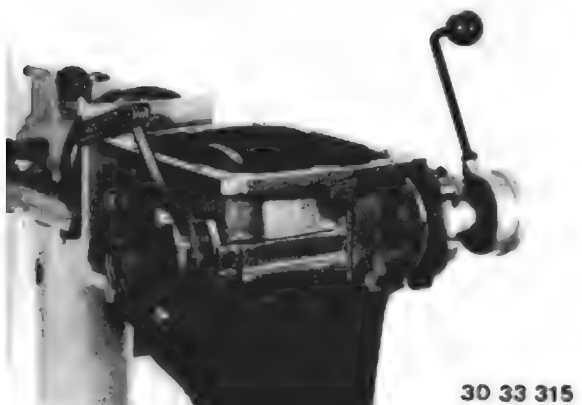
refer to Technical Data 33 11 2AZ.

a thinner shim must be installed on the side facing the crown wheel and the measurement must be repeated.



If the friction torque is reached, although the second bearing cover has not yet been tightened to the specified torque, refer to Technical Data

a thicker shim must be installed beside the crown wheel and the measurement must be repeated.



To make it easier to discover the shim thickness, the gap between shim and transmission case can be measured with a feeler gauge and then added to the thickness used for the shim.

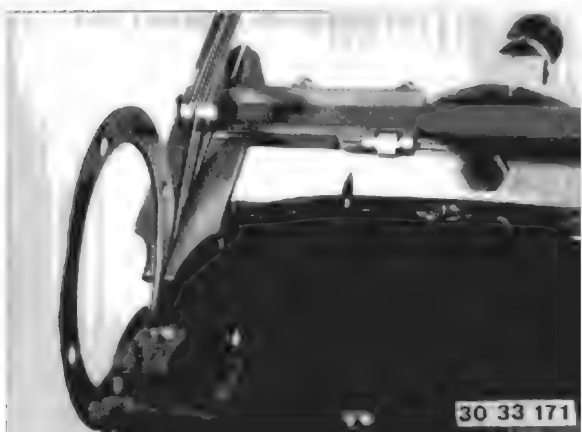
Example:

Second bearing cap not tightened (bolts screwed in uniformly).

Specified friction torque,

refer to Technical Data,

(e.g. 190 Ncm without shaft seal) achieved.



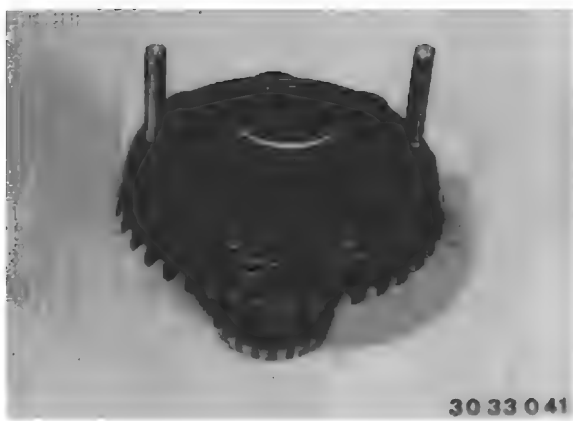
Gap measured with blade	0.20 mm
Used shim	1.40 mm
Install shim of thickness	1.60 mm

Install 1.60 mm thickness of shim and repeat measurement.



Remove differential.

Match side covers and shim of determined thickness, and do not mix them up.



Installation:

Clean tapped bores thoroughly (tapper).

Heat plate spring to max. 100 °C (thermo-chrome pin).

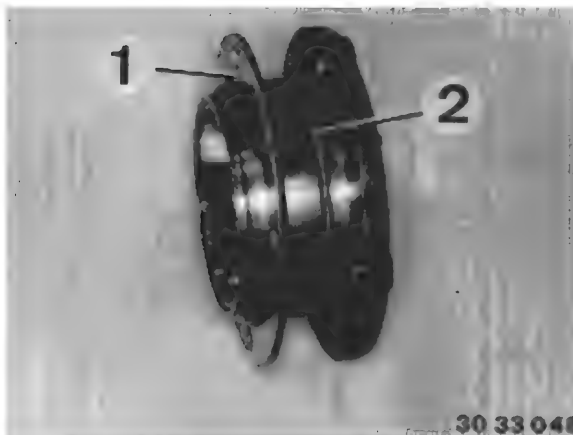
Mount crown wheel with two locally manufactured staybolts for guiding.



Installation:

Install new bolts with Loctite No. 270. Tighten bolts in order of 1 ... 8.

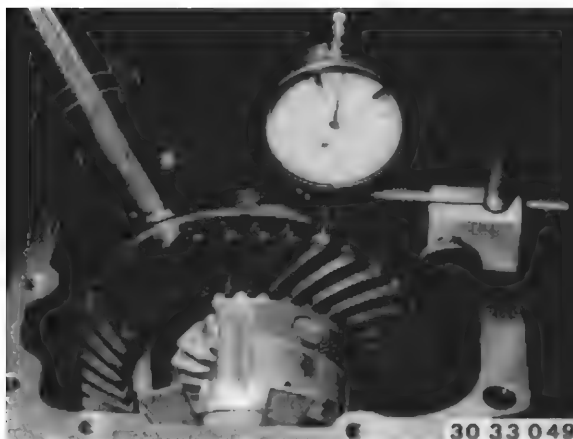
Note Tightening Torque and torsion angle, refer to Technical Data 33 12 1AZ.



Installation:

Install differential with ring gear and pulse gear.

Install side cover after marking with the appropriate washers (1) and new O-ring (2). Tightening Torque, refer to Technical Data 33 11 2AZ.



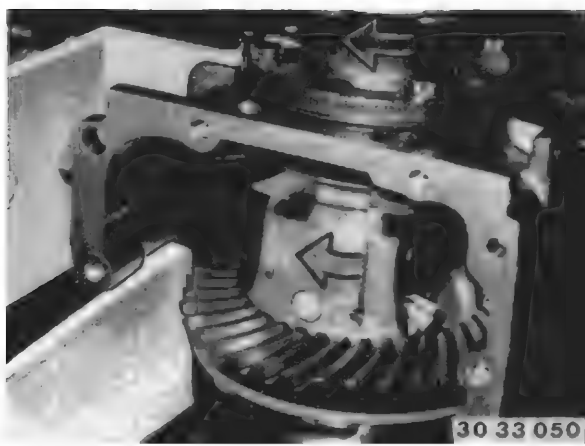
Adjusting torsional face runout/contact pattern:

Secure special tool 00 2 500 (dial gauge holder) and measure torsional face runout, refer to Technical Data.

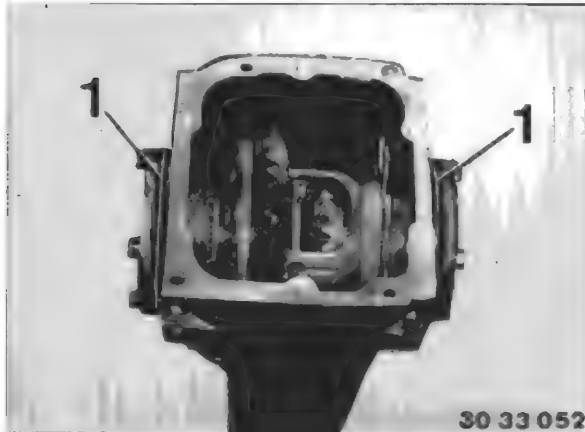
Caution!

The contact pattern is always the key to perfect adjustment of a gear train,

refer to Basic Rules of Contact Pattern Adjustment.



To check the tooth contact pattern, coat the crown wheel teeth with printer's ink, turn in both directions several times and stop crown wheel suddenly with a piece of hard wood.



Correction of torsional face runout and contact pattern is performed by altering the thicknesses of both shims (1).

If backlash is too great, install a thinner shim on the crown wheel end.

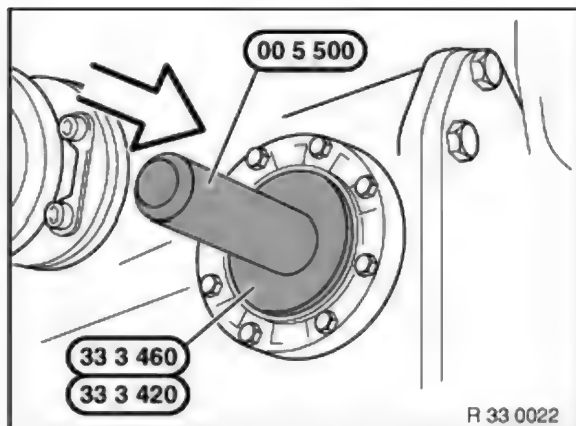
If backlash is too small, use a thicker shim on the crown wheel end.

Axial displacement of the crown wheel of 0.01 mm signifies a change in tooth flank clearance of 0.0076 mm.

Caution!

The total thickness of both shims may no longer be changed.

If a thinner or thicker shim is required to correct the tooth contact pattern, the total thickness must be corrected with the second shim, since otherwise the friction torque of bearings would be changed again.

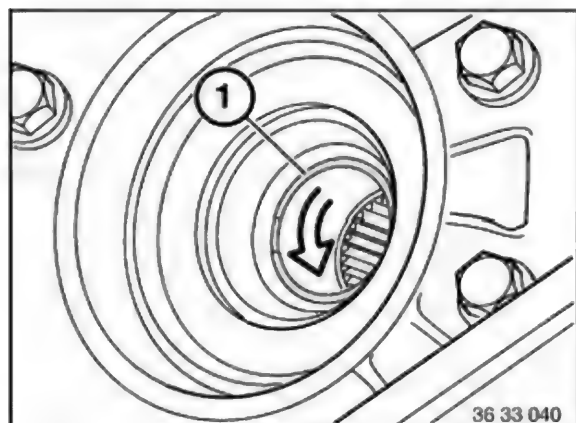


Installation:

Dip shaft seal in final drive oil.

Drive shaft seal firmly home with special tool 33 3 460 in conjunction with special tool 00 5 500.

Replace drive flange if the bearing surface is seriously scored.



Installation:

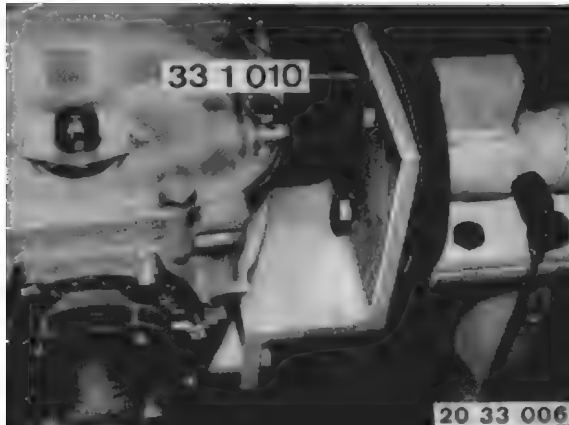
Before fitting the drive flange, the round wire circlip (1) must be placed in the groove of the differential housing in such a way that both ends of the round wire circlip are recessed.

This prevents lateral bending of the ring.

Press in drive flange by hand and turn slightly until wire snap ring is heard to engage.

Replace stretched round wire snap rings.

Remove final drive, refer to pertinent model Repair Instructions microfiche beginning with 1985 models, refer to 33 10 010



Secure final drive to special tool 33 1 010.

Drain oil and remove housing cover.

Installation:

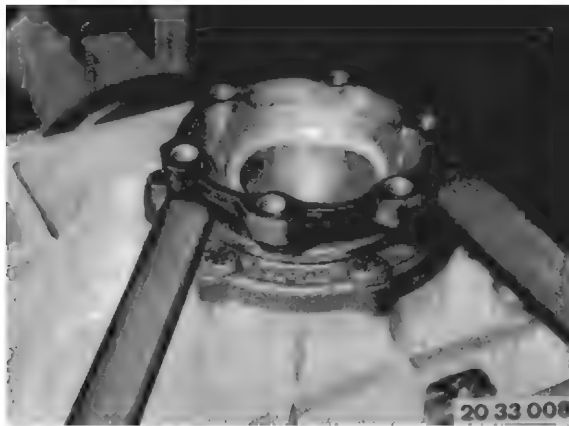
Replace seal.

Tightening Torque,
refer to Technical Data 33 11 1AZ.

Topping up oil.

Oil quantity,
refer to Technical Data.

Oil grade,
refer to BMW Service Operating Fluids.



Remove complete final drive housing,
refer to 33 12 526.

Pry off drive flanges with a tire iron for this purpose.



Mark bearing cap with punch marks and remove.

Caution!

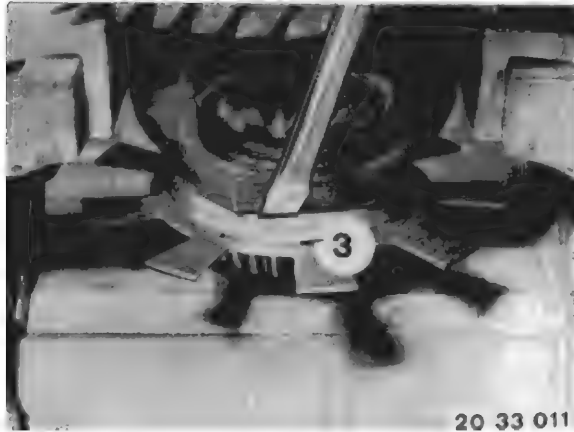
In order to make friction torque adjustments easier, ensure that the bearing caps and spacer discs are not mixed up.



Remove complete differential case.

Caution!

Do not bend the pulse generator wheel.



Press pulse generator wheel off of differential case.

Caution!

Do not bend pulse generator wheel (3).



Installation:

Press fit pulse generator wheel using special tool 33 1 358.



Pull taper roller bearing off differential housing with special tool 33 1 300.

Remove crown wheel (cold).



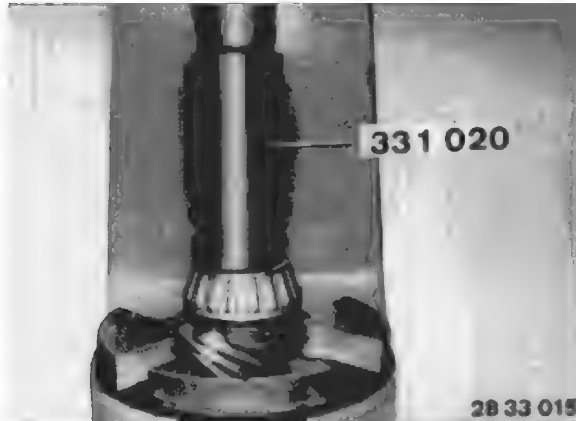
28 33 075

Installation:

Cold-press new taper roller bearing on using special tool 33 1 020.

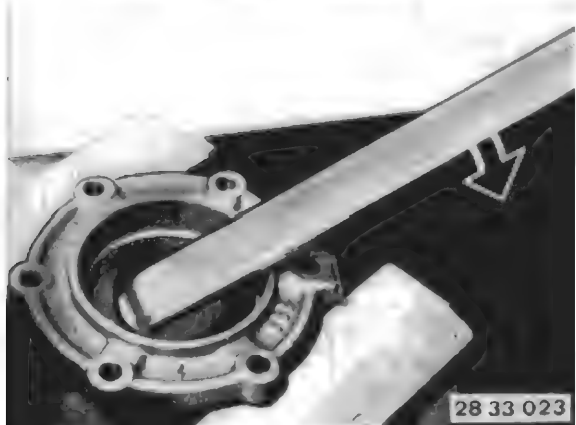
Caution!

Always only use same make bearings for both.



28 33 015

Lift shaft seals out of both bearing caps.

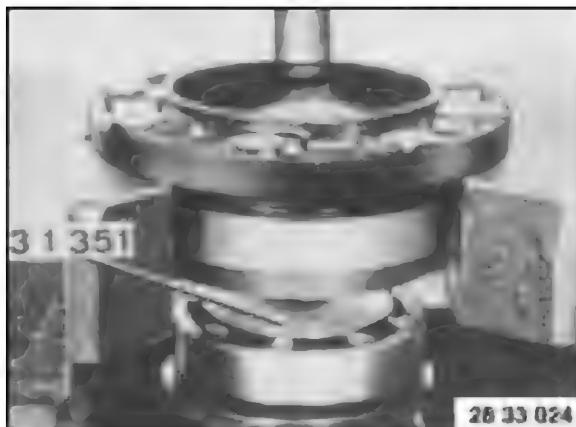


28 33 023

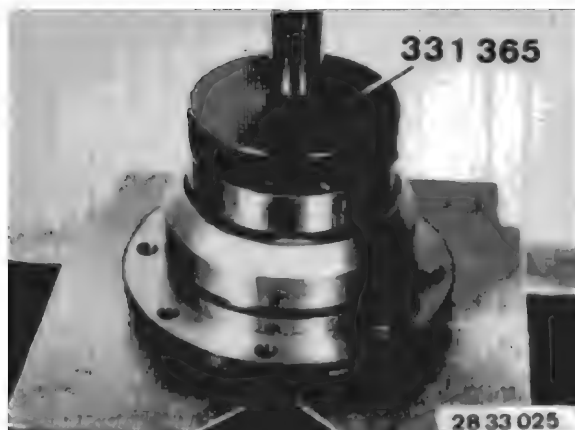
Press outer bearing race out with special tool 33 1 350 / 351.

Caution!

Special tool must engage in the bearing outer race.

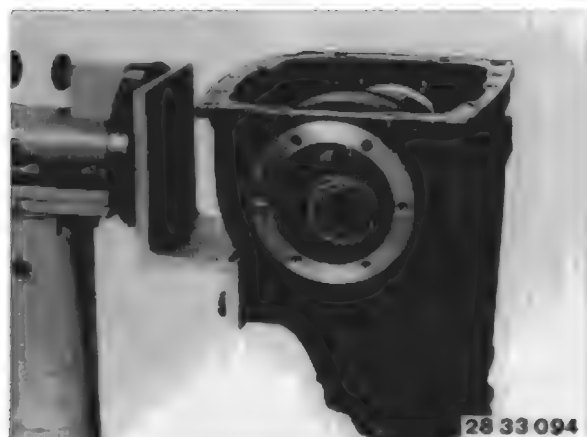


28 33 024



Installation:

Press in new outer bearing races in with special tool 33 1 365.

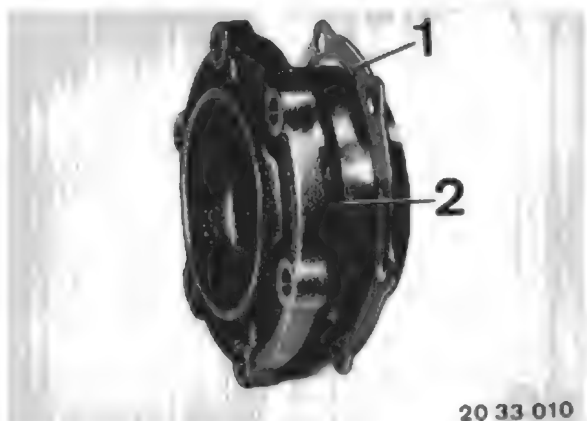


If only the differential bearings are being replaced, the drive pinion can remain installed and the differential case is installed without the ring gear to determine thickness of shims.

Caution!

Note make of bearings - this is required to determine the friction torque.

Lubricate new bearings with approved final drive gear lube thoroughly (refer to Operating Fluids) and let them drip dry.



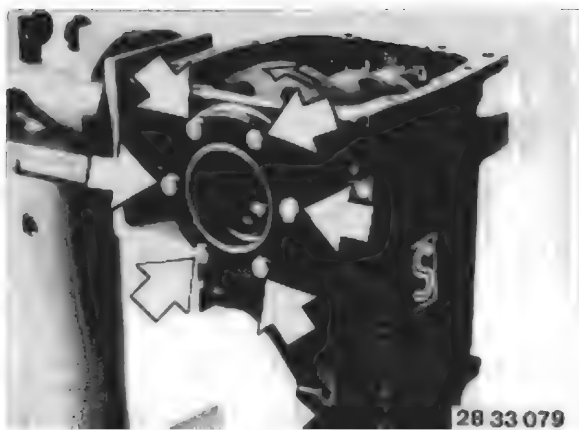
Install side bearing caps as marked with corresponding shims (1), but without O-rings (2) at first.

Uniformly tighten bearing cover screw on sides facing the crown wheel side.

Tightening Torque,
refer to Technical Data 33 11 2AZ.

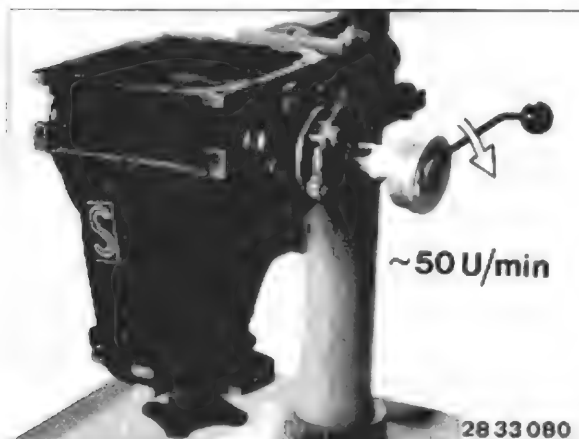


The differential bores (1) always face up when the differential is installed correctly and this can be seen on the outside by way of tab (2).



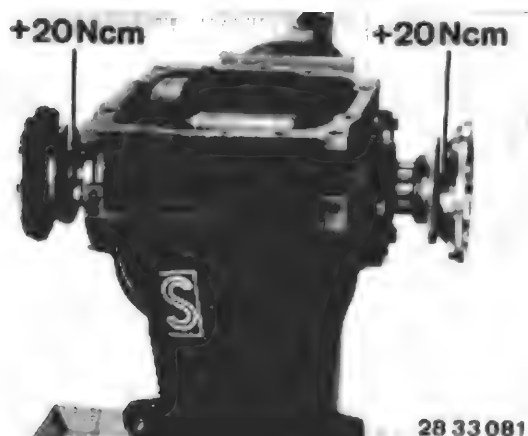
The axial preload force of the differential housing bearing (4000 N) can be determined from the friction torque, refer to Technical Data.

Tighten bolts of second bearing cap uniformly only enough, that the differential can still be turned easily.



On the side tightened down to Tightening Torque, install an output flange and determine friction torque by means of a bracket with welded nut (in-house manufacture) and special tool 00 2 000.

Turn special tool at approx. 50/min.



The friction torque specified in the table for the final drive housing mount should be achieved, but do not exceed this value, refer to Technical Data.

If new shaft seals have already been installed, 20 Ncm must be added for each seal in which an output shaft runs while measuring.



If the specified friction torque is not achieved, although both bearing covers are tightened down to specified Tightening Torque,

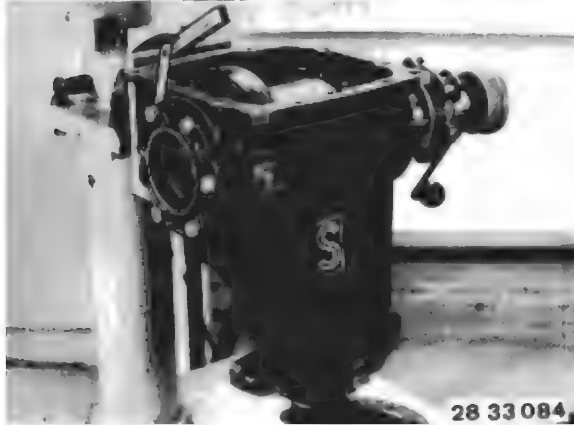
refer to Technical Data,

a thinner shim must be installed on the side facing the crown wheel and the measurement must be repeated.



If the friction torque is reached, although the second bearing cover has not yet been tightened to the specified torque, refer to Technical Data

a thicker shim must be installed beside the crown wheel and the measurement must be repeated.



To make it easier to discover the shim thickness, the gap between shim and transmission case can be measured with a feeler gauge and then added to the thickness used for the shim.



Example:

Second bearing cover not tightened (screws evenly hand-tightened).

Friction torque, refer to Technical Data

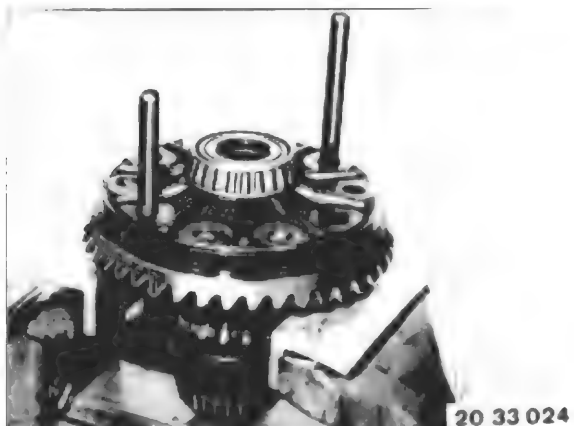
Gap measured with blade	0.20 mm
Used shim	1.40 mm
Install shim of thickness	1.60 mm

and measure again.



Remove differential.

Match side covers and shim of determined thickness, and do not mix them up.

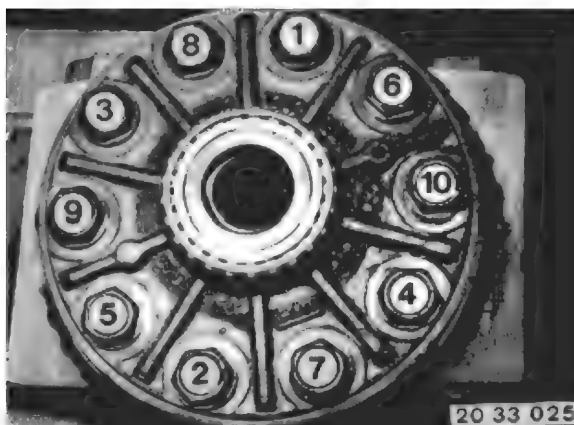


Installation:

Clean tapped bores thoroughly (tapper).

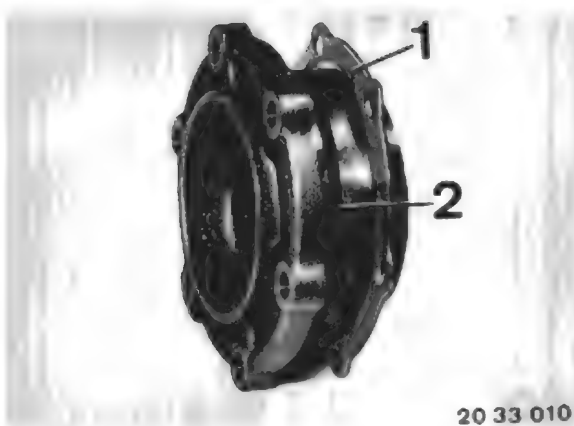
Heat plate spring to max. 100 °C (thermo-chrome pin).

Mount crown wheel with two locally manufactured staybolts for guiding.



Install new bolts with Loctite No. 270. Tighten bolts in order of 1 ... 10).

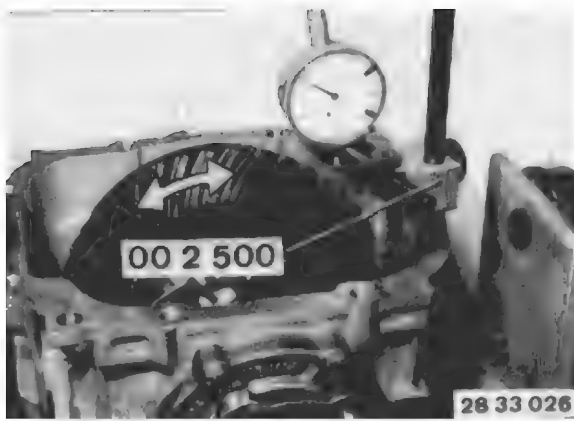
Tightening Torque and torsion angle,
refer to Technical Data 33 12 1AZ.



Install differential with crown wheel and pulse gear.

Install side cover after marking with the appropriate washers (1)
and new O-rings (2).

Tightening Torque,
refer to Technical Data.



Backlash/tooth contact pattern adjustments
Secure special tool 00 2 500 (dial gauge holder) and measure torsional face runout,
refer to Technical Data.

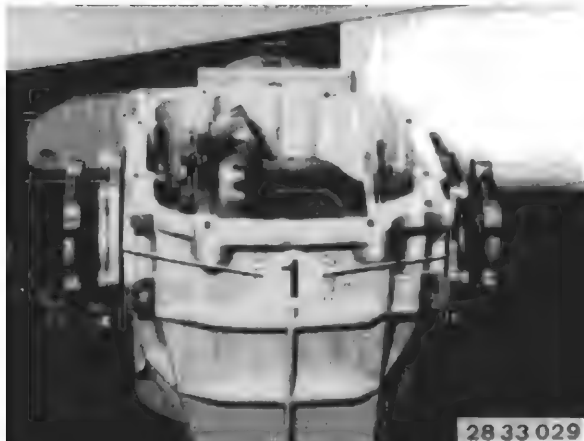
Caution!

The tooth contact pattern is always most important for a perfectly adjusted pinion/crown wheel.

Basic rules for contact pattern adjustment,
refer to 33 12 ...



To check the tooth contact pattern, coat the crown wheel teeth with printer's ink, turn in both directions several times and stop crown wheel suddenly with a piece of hard wood.



A correction to torsional face runout,
refer to Technical Data,

and contact pattern is performed by changing the thickness of both shims (1).

If backlash is too great, install a thinner shim on the crown wheel end.

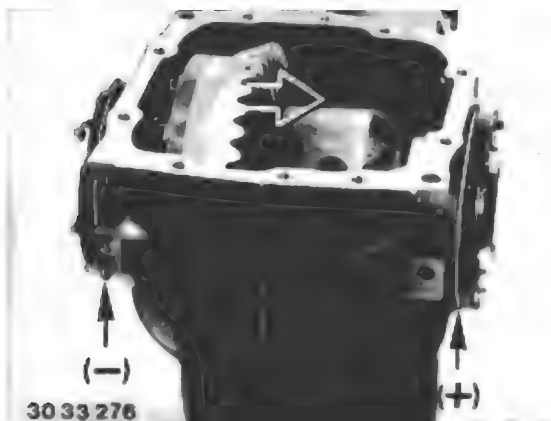
If backlash is too small, use a thicker shim on the crown wheel end.

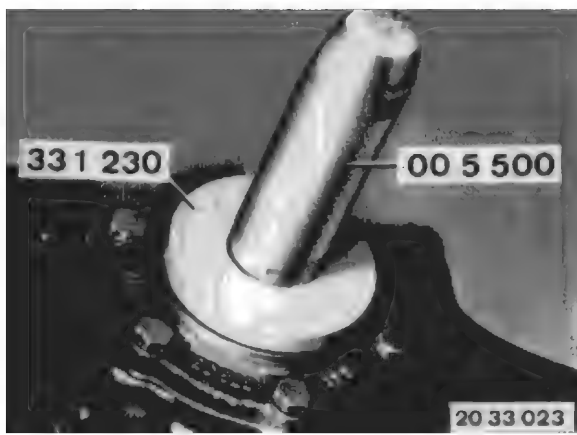
Axial displacement of the crown wheel of 0.01 mm signifies a change in tooth flank clearance of 0.0076 mm.

Caution!

The total thickness of both shims may no longer be changed.

If a thinner or thicker shim is required to correct the tooth contact pattern, the total thickness must be corrected with the second shim, since otherwise the friction torque of bearings would be changed again.





Installation:

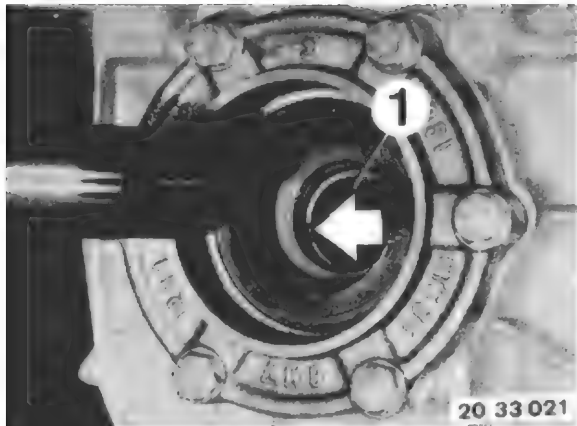
Dip shaft seal in final drive oil.

Drive shaft seal firmly home with special tool 33 1 230 in conjunction with special tool 00 5 500.

Replace drive flange if the bearing surface is seriously scored.

Note:

The special tool 33 1 230 may have to be remachined on account of the casting tolerances.



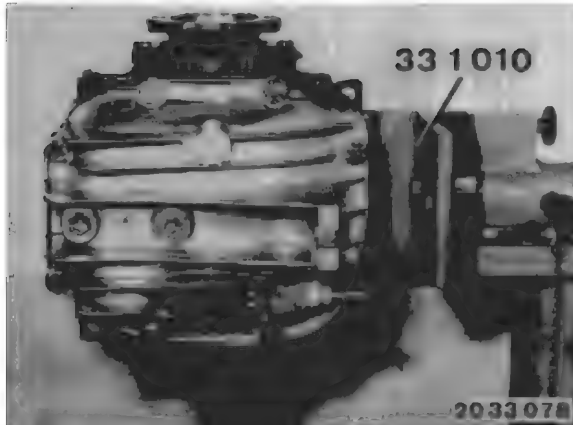
Installation:

Place round wire snap ring (1) in the groove of the differential case in such a manner that both ends of the round wire snap ring are recessed in the groove, before installing the drive flange.

This prevents lateral bending of the ring.

Press in drive flange by hand and turn slightly until wire snap ring is heard to engage.

Replace stretched snap rings.



Removing and installing final drive, included in Repair Manual MF, model-dependent, from '85, refer to 33 10 010.

Drain ATF.

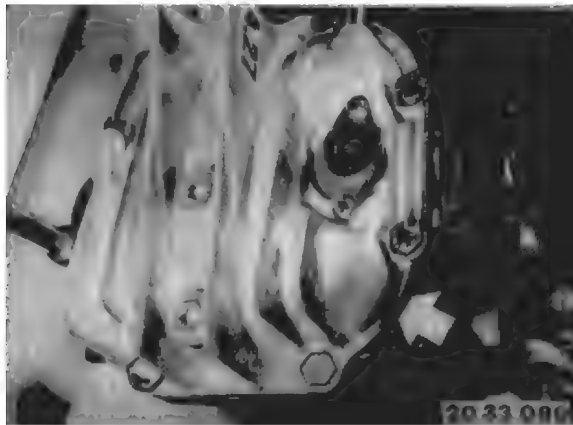
Secure final drive to special tool 33 1 010 (retaining bracket).

Installation:

Add oil.

Oil volume, refer to Technical Data

Refer to Fluids and Lubricants for approved oil.

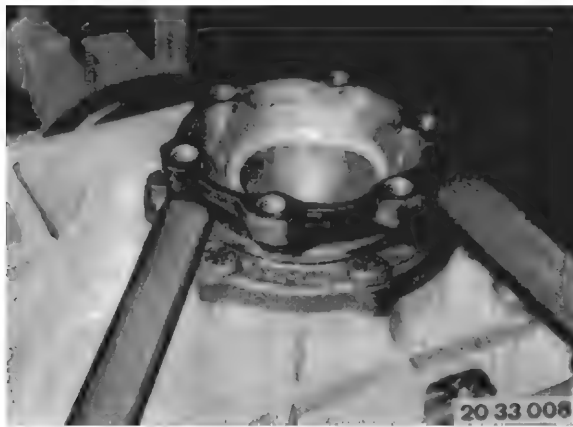


Take off case cover.

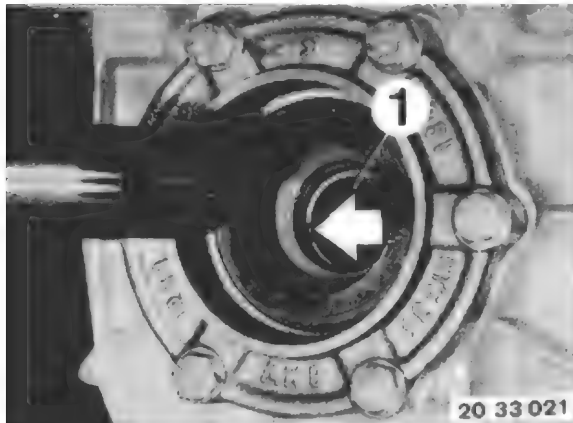
Installation:

Replace gasket.

Tightening torque, refer to Technical Data



Press off both drive flanges with a tire iron.



Installation:

Place round wire snap ring (1) in groove of differential case prior to installation of the drive flange, that both ends are recessed in the groove. This prevents lateral bending of the ring.

Press in drive flange by hand and turn slightly until wire snap ring is heard to engage.

Replace stretched snap rings.



Installation:

Differential case bearings and backlash are adjusted with shims (1).

Check O-ring (2), replace if necessary.

Caution!

Changing the total thickness of shims (1) will change the friction torque value.

After adjustment of the friction torque, torsion face runout and contact pattern must be readjusted, refer to 33 12 551

Remove complete limited slip differential.

Installation:

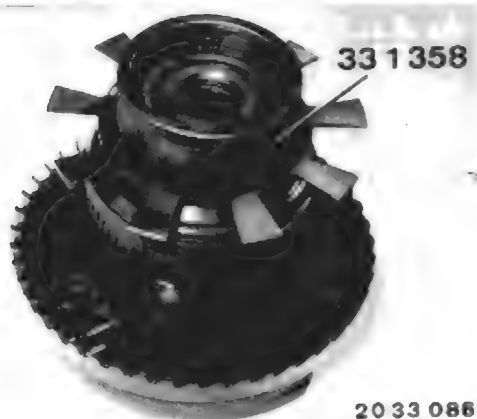
Don't bend the pulse spider.



Press off pulse spider.

Installation:

Press fit pulse generator wheel with special tool 33 1 358 (union ring).



Remove crown wheel (cold).





Press-fit new taper roller bearing to new final drive case with limited-slip differential cold using special tool 33 1 003.

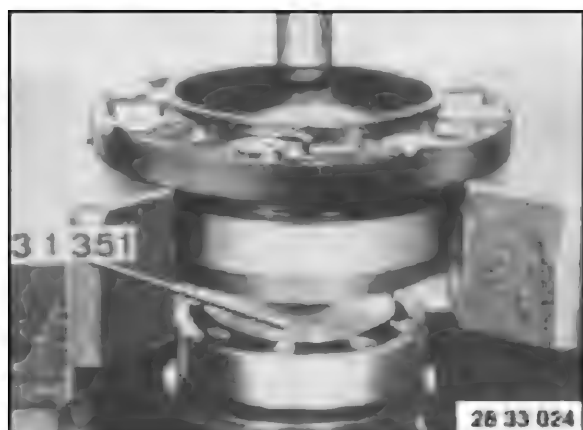
Caution!

Only use same make bearings for both bearings.

Note make - this information is required later to determine the friction torque.



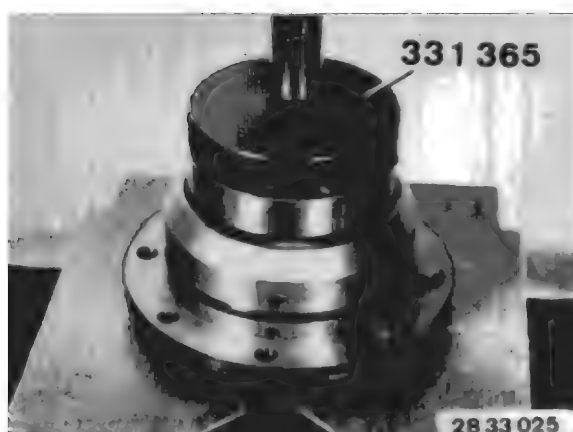
Lift shaft seals out of both bearing caps.



Press out outer bearing race with special tool 33 1 350 (extractor fixture) and special tool 33 1 351 (extractor star tool).

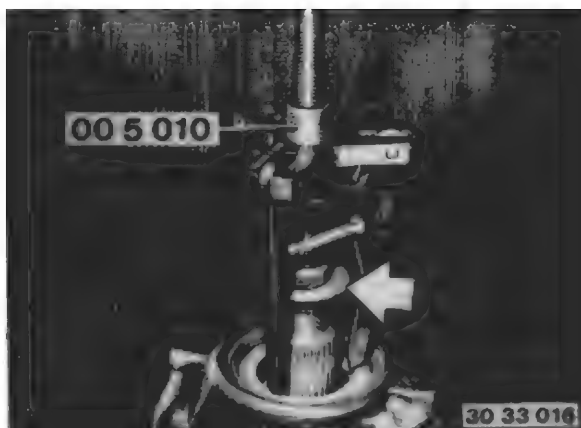
Caution!

Special tool must engage in the bearing outer race.

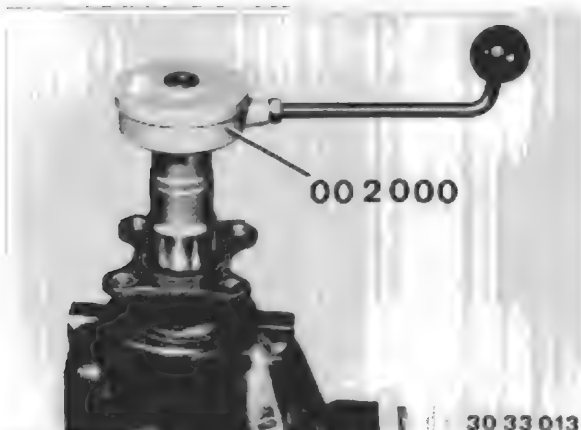


Installation:

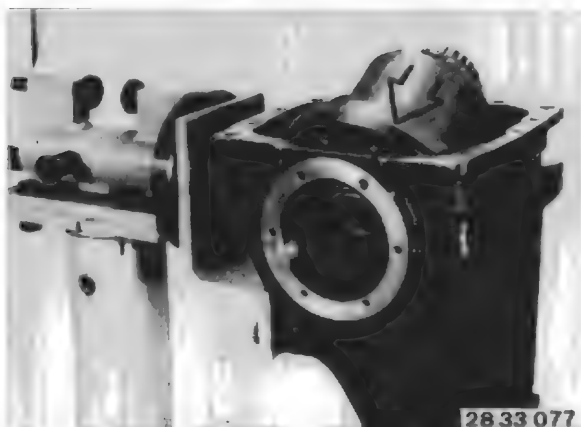
Press-fit new bearing outer races with special tool 33 1 365 (pressure plate).



If necessary, replace shaft seal for input flange,
refer to 33 11 021



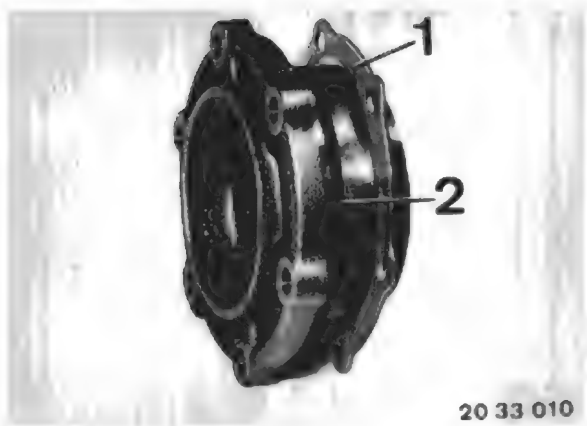
If necessary input bevel gear,
refer to 33 12 551



Install new limited slip differential with new bearings.
Use both bearings of same make. Note make.



Lubricate new bearings with approved final drive gear lube
thoroughly (refer to Fluids and Lubricants) and let them drip dry.



20 33 010

Install side bearing caps marked with belonging shims (1), but at first without O-rings (2).

Evenly tighten bearing cover screws opposite the crown wheel, Tightening torque, refer to Technical Data.



28 33 072

Installation:

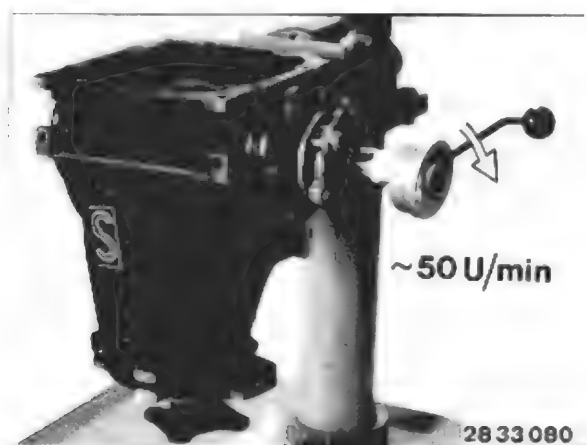
Compensating bores (1), recognized on the outside tab (2), always face up in installed position of transmission.



28 33 079

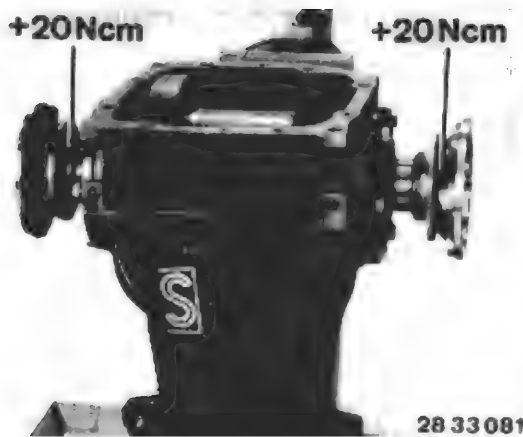
The axial preload force of the final drive mount (4000 N) can be determined from the friction torque, refer to Technical Data

Tighten bolts of second bearing cap uniformly only enough, that the differential can still be turned easily.



28 33 080

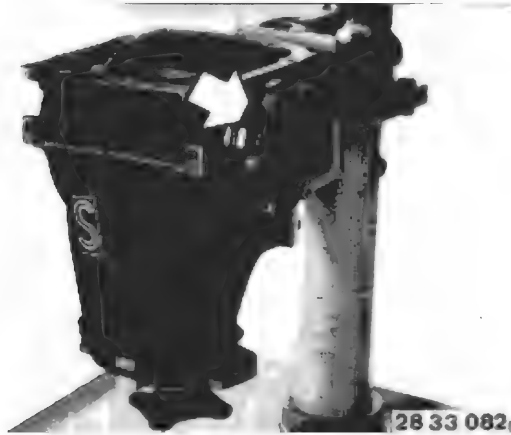
On side opposite crown wheel, fit an output flange and determine friction torque using a bracket with welded on nut (in-house manufacture) and special tool 00 2 000 (friction torque gauge). Turn friction torque meter at speed of approx. 50 rpm.



The friction torque specified in the final drive mount table should be achieved but not exceeded,

refer to Technical Data

If new shaft seals have already been fitted, 20 Ncm must be added to each seal in which an output shaft rotates during the measurement process.



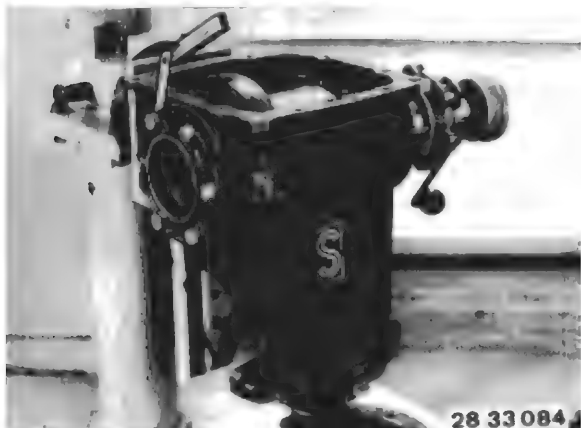
If the specified friction torque is not achieved although both bearing covers are at specified tightening torque,
refer to Technical Data

a thinner shim must be installed opposite the crown wheel and the measurement must be repeated.



If the specified friction torque is reached although both bearing covers are tightened to the specified tightening torque,
refer to Technical Data

a thicker shim must be installed opposite the crown wheel and the measurement must be repeated.



To make finding the thickness of shims easier, the distance between the shim and case can be measured with a feeler gage blade and this value is then added to the thickness of the used shims.



Example:

Second bearing cover not tightened down (screws tightened evenly).

Friction torque, refer to Technical Data

Gap measured with blade	0.20 mm
Used shim	1.40 mm
Install shim of thickness	1.60 mm

Measure again.



Remove differential case.

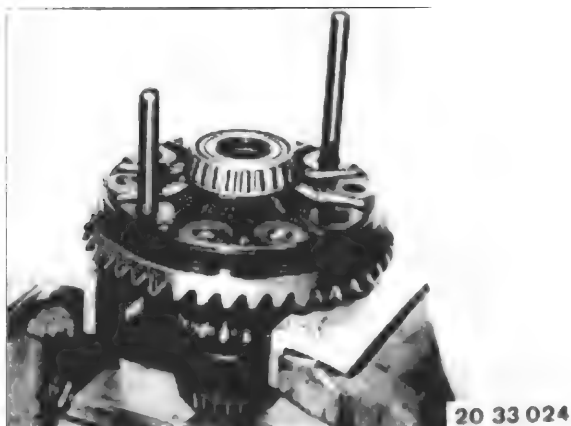
Arrange side covers and shims of determined thickness - don't mix them up.



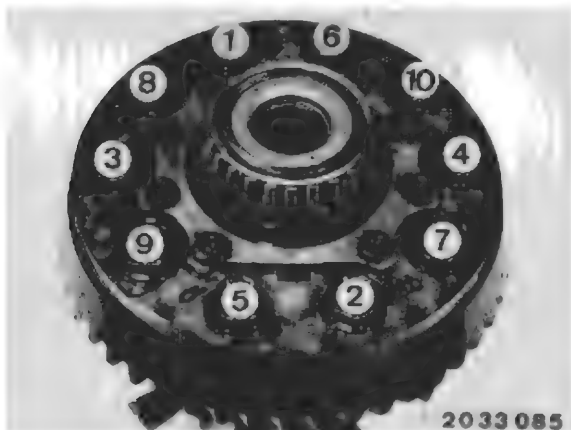
Installation:

Clean tapped bores thoroughly (tapper).

Heat plate spring to max. 100° C (thermo-chrome pin).



Mount crown wheel with two locally manufactured staybolts for guiding.



Install new bolts with Loctite No. 270. Tighten bolts in order of 1 ... 10.

Tightening torque and torsion angle, refer to Technical Data

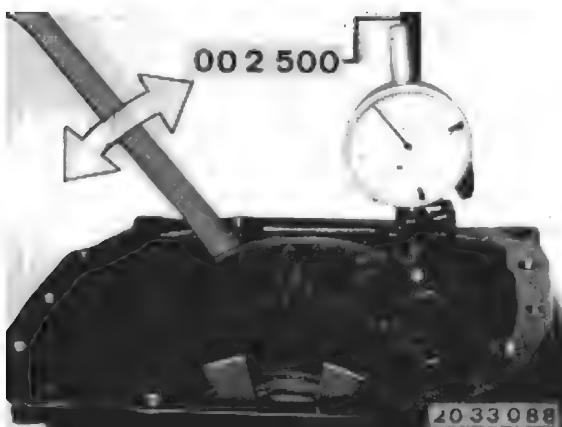


Install new limited slip differential with crown wheel and pulse sender.

Install marked side bearing covers with corresponding washers and new O-rings.

Tighten bearing cover screws evenly.

Tightening torque, refer to Technical Data



Secure special tool 00 2 500 (dial gauge holder) and measure torsion flank clearance, refer to Technical Data

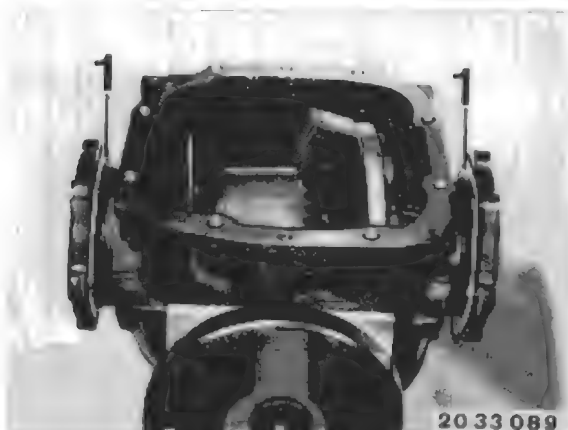
Caution!

The contact pattern is always the indicator for perfect gear adjustment,

refer to 33 12 551



To check the tooth contact pattern, coat the crown wheel teeth with printer's ink, turn in both directions several times and stop crown wheel suddenly with a piece of hard wood.



Correction of torsion clearance,
refer to Technical Data

and contact pattern is performed by altering the thickness of both shims (1).

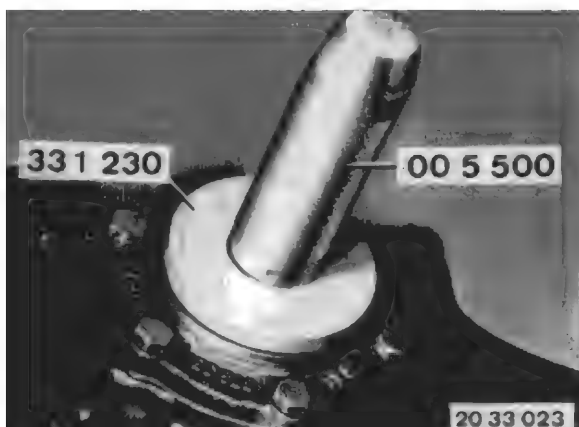
If backlash is too great, install a thinner shim on the crown wheel end.

If backlash is too small, use a thicker shim on the crown wheel end.

Axial displacement of the crown wheel of 0.01 mm signifies a change in tooth flank clearance of 0.0076 mm.

Caution!

The total thickness of both shims may no longer be changed. If a thicker or thinner shim was required to correct the tooth contact pattern, the total thickness must be corrected with the second shim, since otherwise the friction torque of the bearings would be changed again.



Installation:

Dip new shaft seals in final drive gear lube.

Drive in shaft seal firmly with special tool 33 1 230 (impact bush) in conjunction with special tool 00 5 500 (handle).

Note:

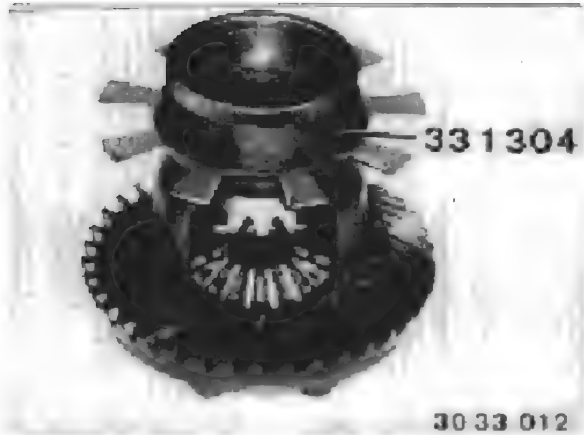
It is possible that the special tool 33 1 230 might have to be reworked to compensate for casting tolerances on the side cover.

Remove final drive housing, contained in Replace drive pinion with crown wheel,
refer to 33 12 551.

Press off pulse spider.

Installation:

Press on pulse alternator wheel with special tool 33 1 304 (union ring).



Remove crown wheel (cold).

Caution!

If the bearings are also replaced, first install crown wheel after determining friction torque determination - replace bearings for differential,
refer to 33 11 731.

Installation:

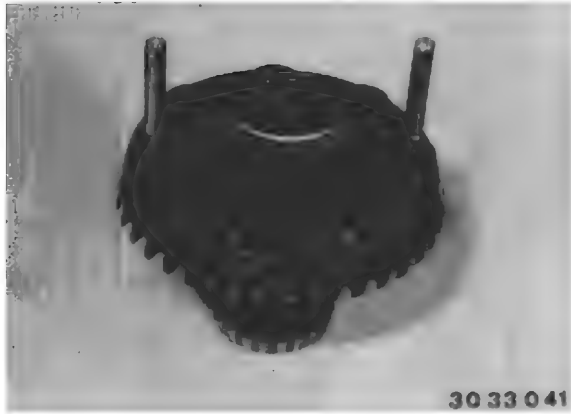
Clean tapped bores thoroughly (tapper).

Heat plate spring to max. 100 °C (thermo-chrome pin).

Mount crown wheel with two locally manufactured staybolts for guiding.

Caution!

Use new ring gear bolts.

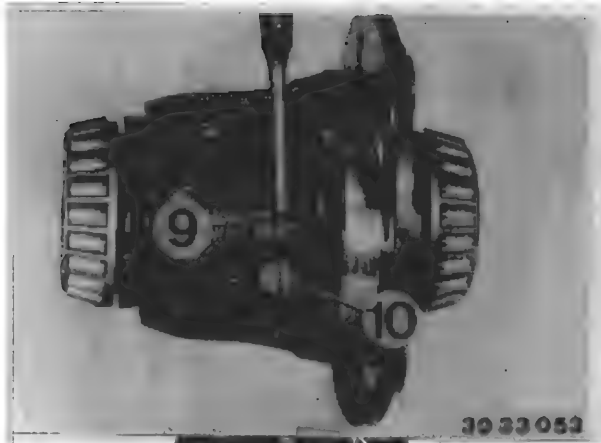


Installation:

Tighten new bolts in order of 1 ... 8.

Tightening Torque,
refer to Technical Data 33 12 1AZ.

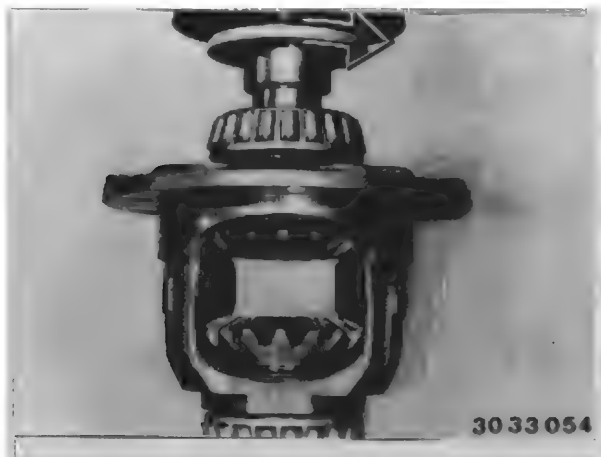




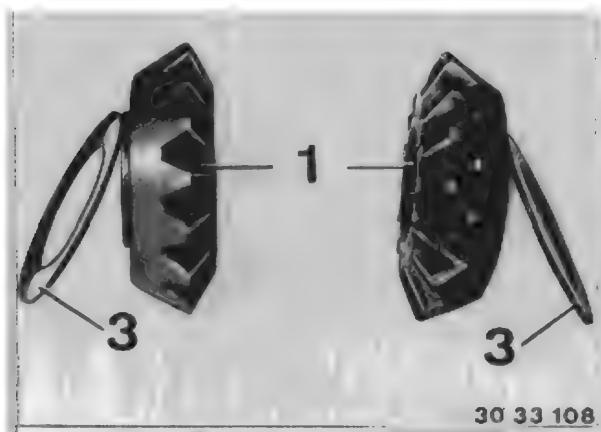
Drive out key (9) and differential shaft (10).

Installation:

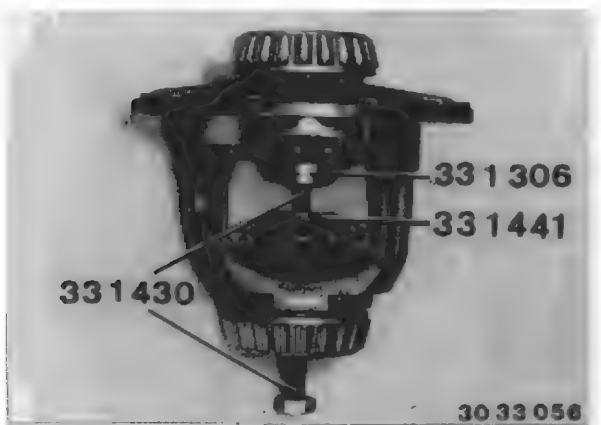
The bore in differential shaft (10) is countersunk on one end.
Drive in key (9) from this end.



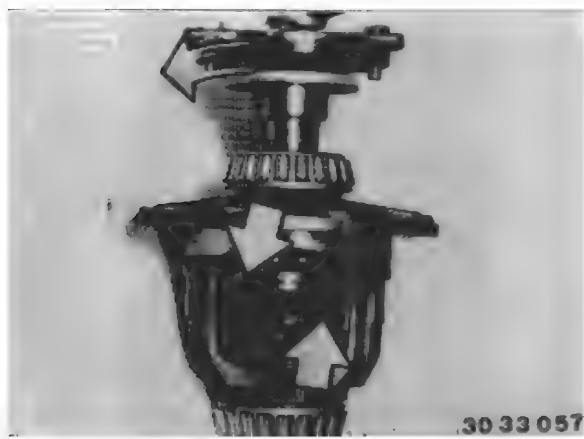
Turn out differential pinion gears with drive flange.
Remove differential side gears with shims.



To gauge the shims, install both new differential side gears (1)
with disk springs (3) without shims (2).
Center differential side gears with the drive flange.

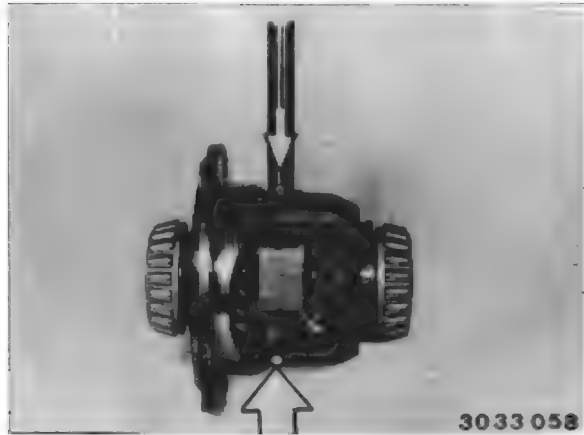


Install special tool 33 1 306 (pressure piece) on one side.
Screw in special tool 33 1 441 (threaded plate) with special tool
33 1 430 (screw).
Tighten special tool bolt to spread differential side gears so far
apart, that the drive flange can just barely be turned.



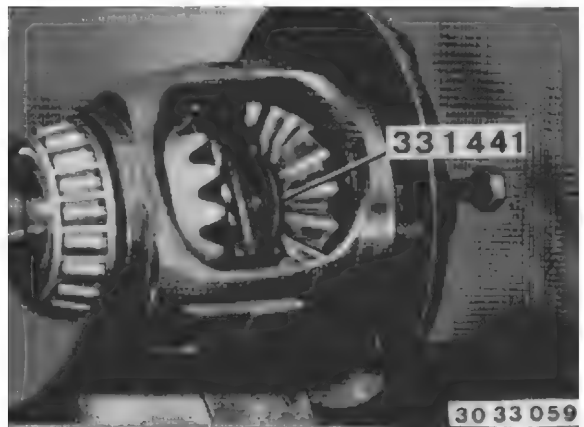
Install differential pinion gears exactly opposite each other.
Move differential gears to installed position by turning drive flange.

Remove special tools.



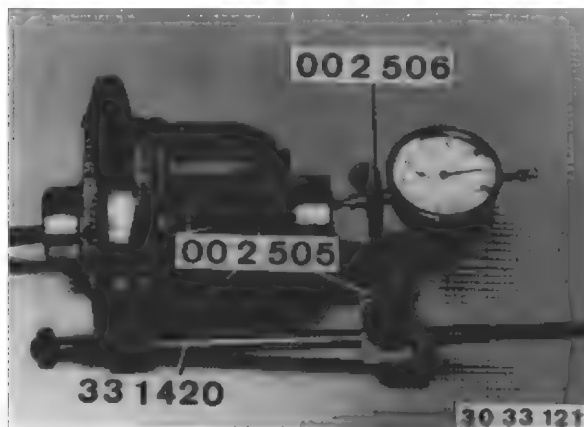
Drive in differential gear shaft.

Turn differential pinion gears with the drive flange and stop them at the highest point of tooth mesh (hardest to turn).



For measurement operation, install special tool 33 1 441 (threaded plate) and special tool 33 1 431 (screw).

If applicable, open up thread plate slightly to make it easier to insert the dial gage. Screw in bolt far enough, that the shaft gear is on "block".



Secure special tool 33 1 420, 00 2 505 and 00 2 506 to final drive housing.

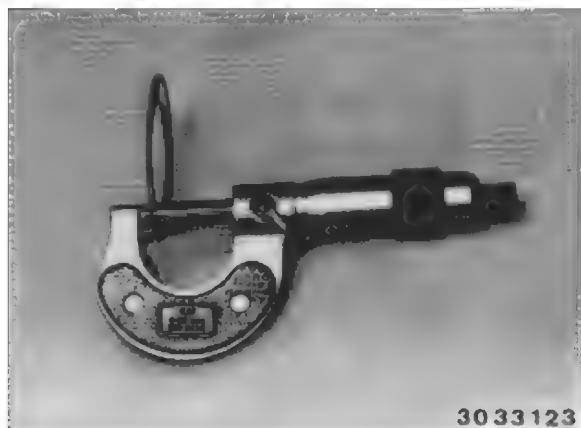
Set dial gage on blocked shaft gear to zero with preload.



Unfasten special tool 33 1 431 (screw).

Read off dial gauge, record value and allocate to one side, e.g. side of crown wheel 0.36 mm.

Repeat measurement on opposite differential side gear and note down value, e.g. 0.28 mm.



Remove differential side gears and diaphragm springs.

Caution!

Don't mix up differential side gears and diaphragm springs.

Measure plate spring with micrometer, record values and allocate, e.g. crown wheel 1.16 mm, other side 1.18 mm.

Determine correct thickness of shim taking into account the clearance of 0.02 ... 0.07 mm.



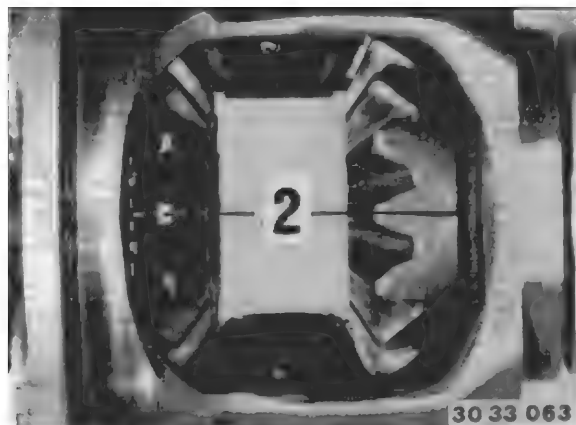
Example:

Ring gear end	Opposite end
Plate spring thicknesses	1.16 mm
+ measured value	0.36 mm
Total	1.52 mm
- play	0.02 mm
	1.50 mm

Thickness of shim:

$1.50 \text{ mm} - 1.44 \text{ mm} = 0.06 \text{ mm}$

Shims (2) are available in gage steps of 0.05 mm.



Install shims (2) of determined thickness.



Removing final drive housing: operation included in "Replacing drive pinion with crown wheel",

refer to 33 12 551

Press off pulse spider.

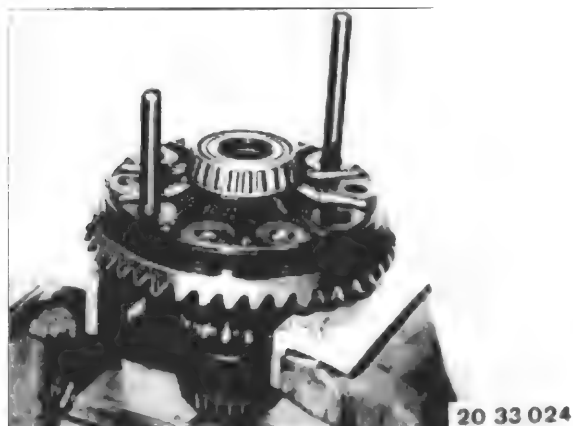
Installation:

Press fit pulse generator wheel with special tool 33 1 358 (union ring).

Remove ring gear (cold).

Caution!

If bearings were replaced, do not install crown wheel until after friction torque has been determined, similar to replacing bearings on final drive housing, refer to 33 11 731.

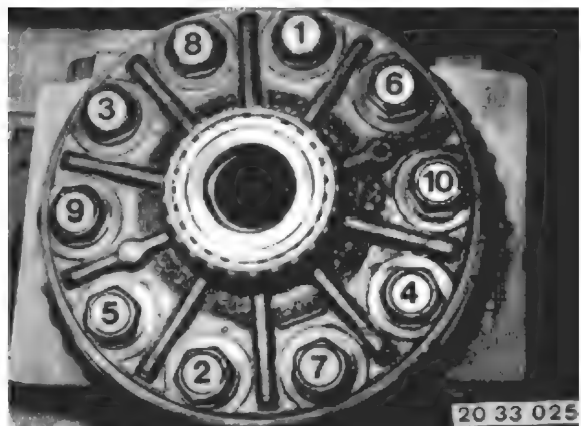


Installation:

Clean tapped bores thoroughly (tapper).

Heat plate spring to max. 100° C (thermo-chrome pin).

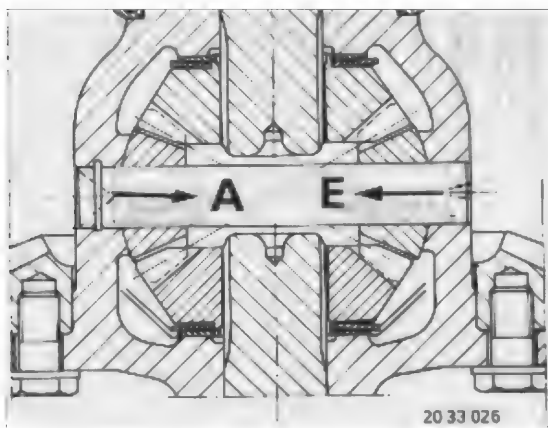
Mount ring gear with two locally manufactured staybolts for guiding.



Installation:

Install new screws with Loctite No. 270 and tighten down in sequence (1 ... 10).

Tightening torque and torque angle, refer to Technical Data



Press out final drive shaft with special tool 33 1 470 (feed mandrel) from countersunk side.

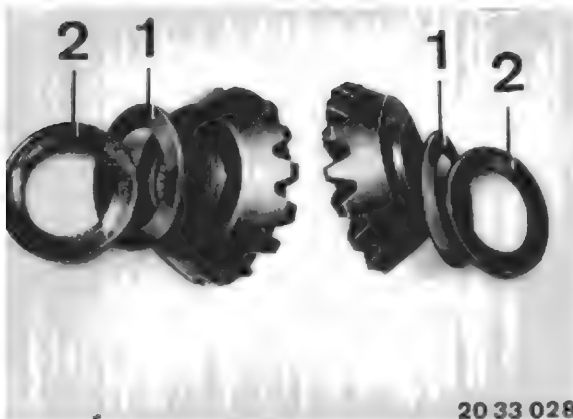
A = Pressing out direction

E = Pressing in direction



Turn out differential bevel gears with drive flange.

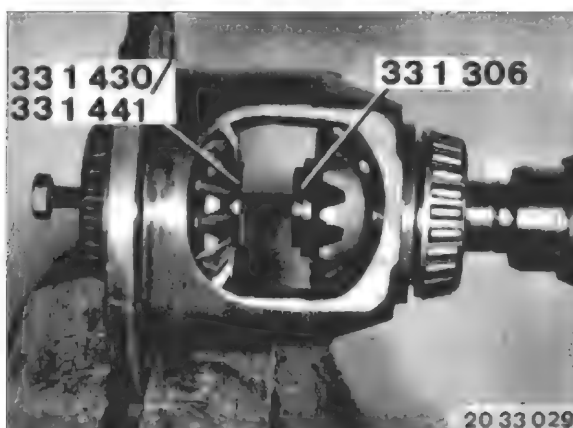
Remove differential side gears with diaphragm springs and shims.



Install both differential side gears with diaphragm springs (1) and shims (2).

Curved surface of diaphragm springs (1) faces differential case.

Center differential side gears with the drive flange.



Install special tool 33 1 306 (pressure piece) on one side.

Screw in special tool 33 1 441 (threaded plate) with special tool 33 1 430 (spindle).

Tighten special tool bolt to spread differential side gears so far apart, that the drive flange can just barely be turned.



Install differential pinion gears exactly opposite each other.
Move differential gears to installed position by turning drive flange.

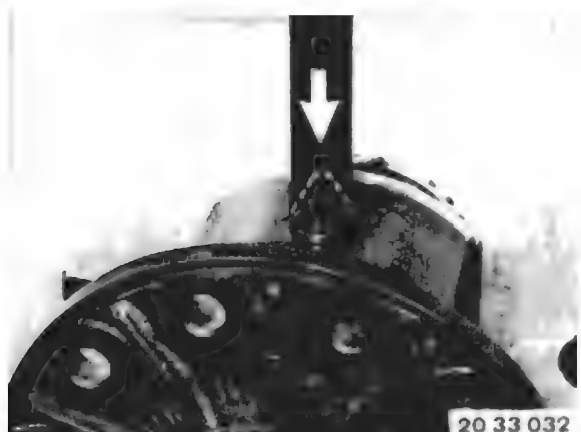
Remove special tools.



Procedure with Hydraulic Press:

Check that circlip (1) is in correct installed position.

Slide in feed mandrel from side without a circlip.



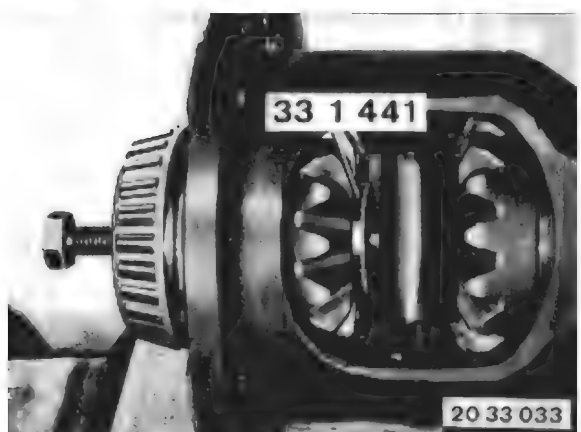
Place differential shaft with large opening on the feed mandrel and press in.

The pressing-in force will increase strongly, when the circlip has engaged.

Caution!

Stop the pressing-in step as soon as the force increases - danger of shearing off the circlip.

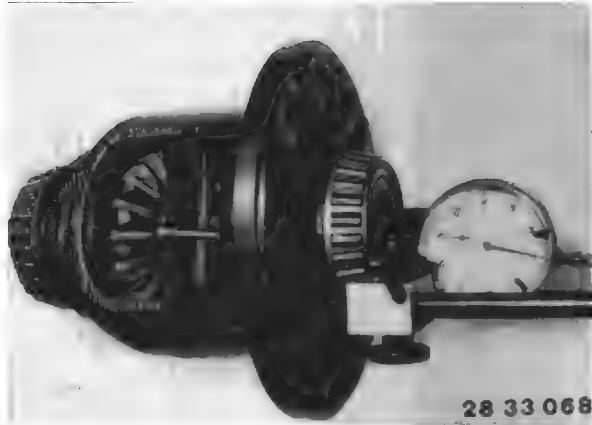
Do not push back the differential shaft after installation.



Measuring Preload of Diaphragm Springs:

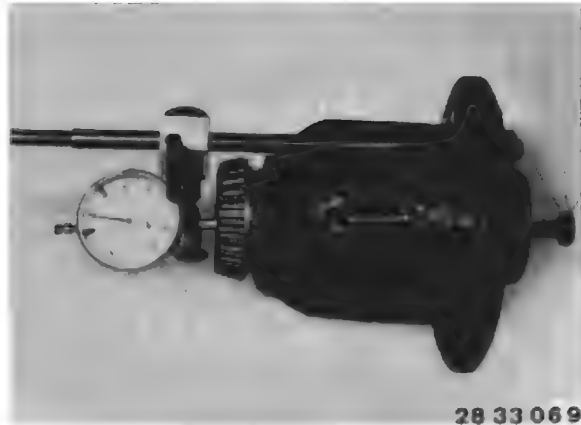
Install special tool 33 1 441 (threaded plate) and special tool 33 1 431 (screw).

Tighten bolt by hand.



Secure dial gauge to final drive housing with special tool 33 1 420, 00 2 505 and 00 2 506.

Set dial gage on blocked shaft gear to zero with preload.



Tighten spindle until diaphragm springs are pressed flat.

Read dial gage. Loosen spindle.

Turn shaft gear and measure again at several points.

To ensure that the plate spring is not block-preloaded, clearance of 0.03 ... 0.1 mm must be available.

The lower value would be ideal.

Repeat measurements on opposite shaft gear.



Excessive Clearance:

Install thicker shim.

Insufficient Clearance:

Install thinner shim.

Shims (2) are available in gage steps of 0.05 mm.

The opposite end is determined in the same manner.

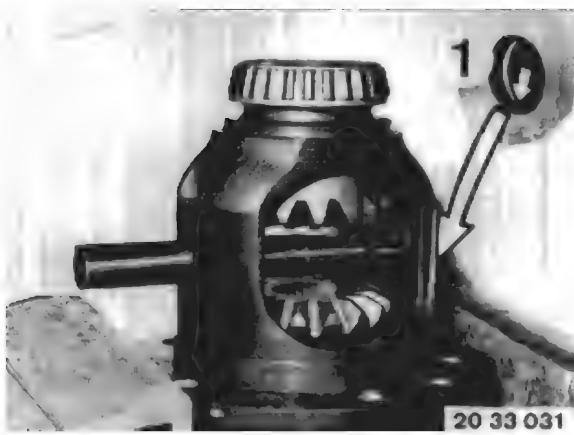
20 33 036



Install shims (2) of determined thickness and diaphragm springs (1).

Inside curved surfaces of diaphragm springs (1) face differential case.

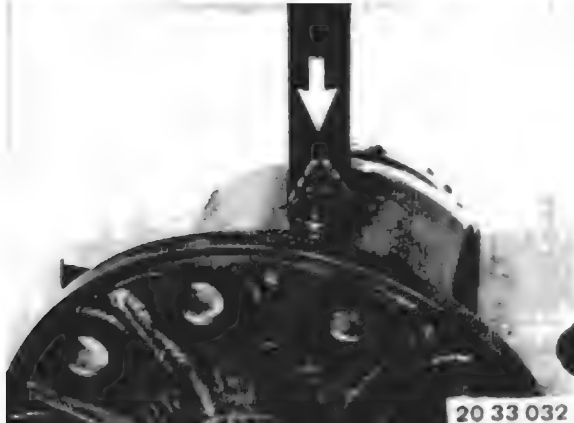
20 33 028



Operation with special tool 00 8 500 (extractor fixture)

Check that circlip (1) is in correct installed position.

Slide in special tool 33 1 470 (feed mandrel) on the side without circlip.



Place differential gear shaft with large opening on special tool and press in until 1 to 2 cm of shaft is visible.



Fit special tool 00 8 500 (extractor fixture) to final drive basket.

Torque = 22 Nm

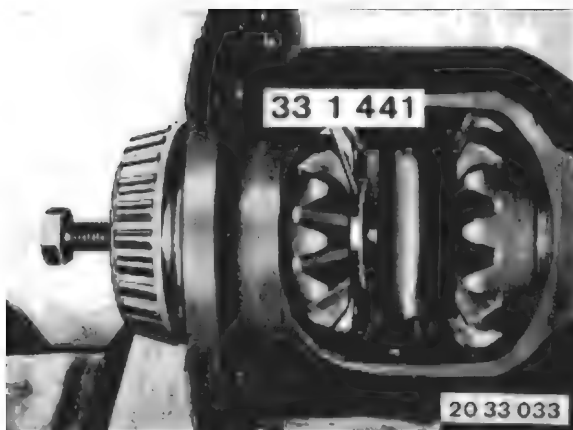
(threaded spindle diameters 18 mm and 20 mm)

Caution!

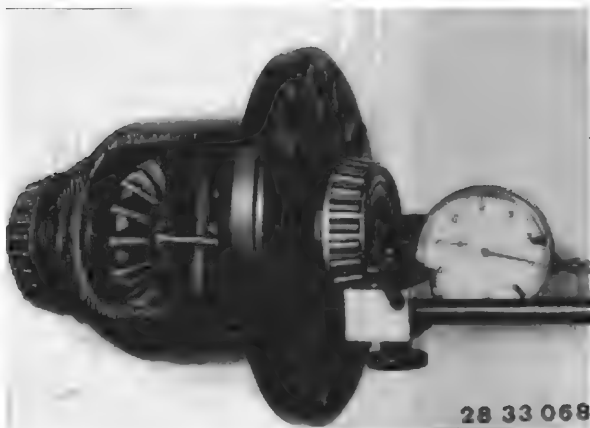
Lubricate center on differential gear shaft with oil before application of the special tool.

Differential gear shaft must no longer be pushed back after installation.

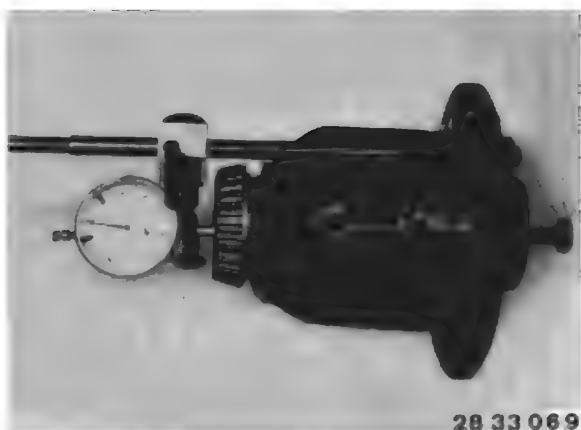
Always ensure that the last quarter of the torque (from approx. 17 Nm) is tightened at a uniform speed (i.e. smoothly and evenly).



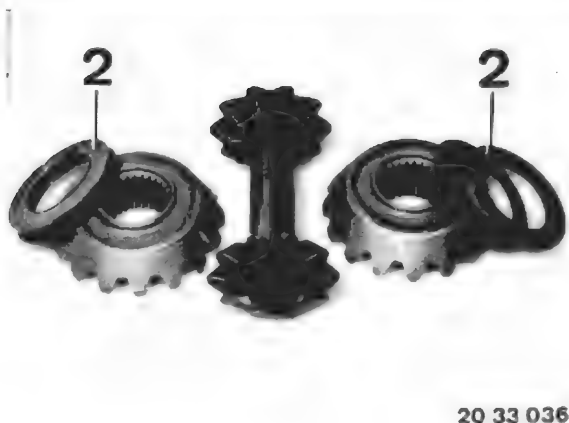
To measure preload of plate springs, install special tool 33 1 441 (threaded plate) and spindle. Tighten spindle by hand.



Mount holder with dial gage.
Set dial gage to zero with preload.



Tighten spindle until diaphragm springs are pressed flat.
Read dial gage. Loosen spindle.
Turn shaft gear and measure again at several points.
To ensure that the plate spring is not block-preloaded, clearance of 0.03 ... 0.1 mm must be available.
The lower value would be ideal.
Repeat measurements on opposite shaft gear.

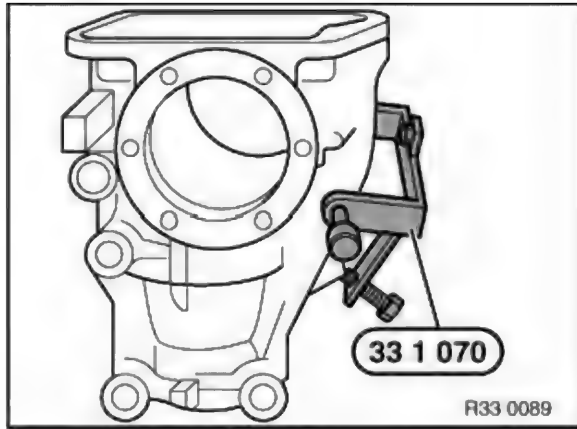


Excessive Clearance:
Install thicker shim.
Insufficient Clearance:
Install thinner shim.
Shims (2) are available in gage steps of 0.05 mm.
The opposite end is determined in the same manner.



Install shims (2) of determined thickness and diaphragm springs (1).

Inside curved surfaces of diaphragm springs (1) face differential case.

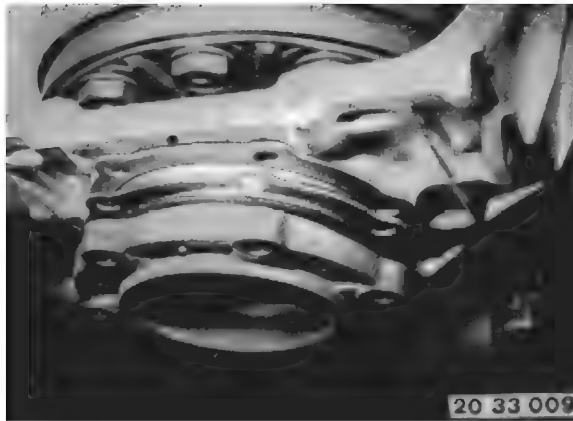


Remove final drive,
refer to 33 10 010.

Secure final drive to assembly frame with special tool 33 1 070.
Drain off fluid. Take off case cover.

Installation:

Tightening torque,
refer to Technical Data 33 11 1AZ.
Top up oil level,
refer to Technical Data.



Remove complete final drive housing.

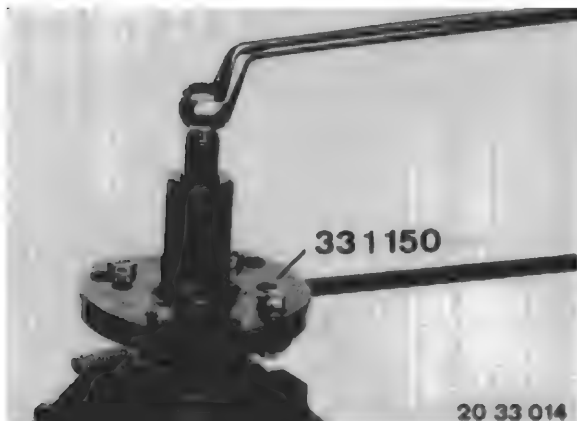
Caution!

Mark out bearing cover: do not confuse shims.



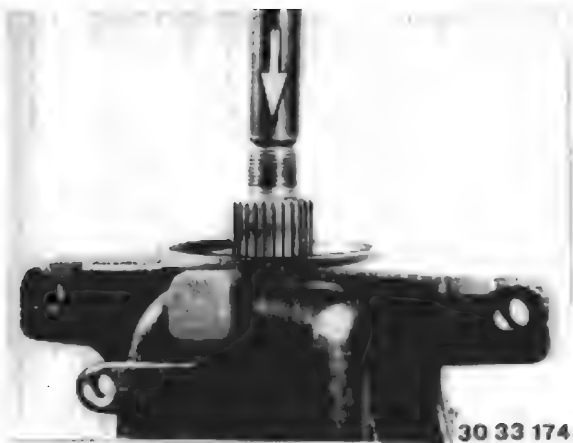
Remove lockplate.

Unfasten nut (1) and brace with special tool 23 0 020.



Remove input flange with special tool 33 1 150.

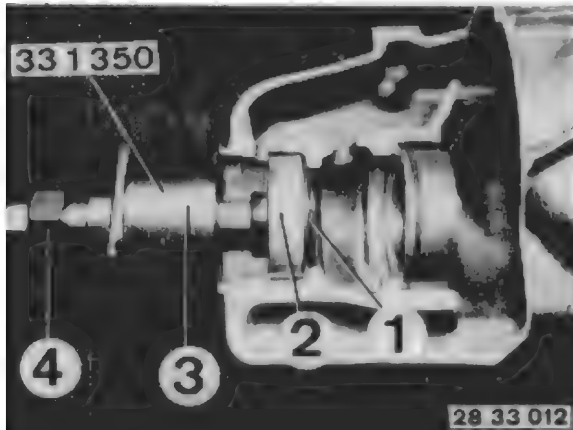
Specified friction torque is indicated on the new drive pinion bearing and friction torque of old bearing does not have to be measured.



Press out drive pinion.

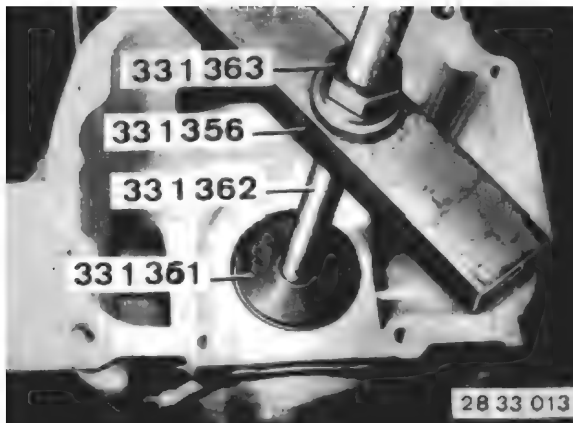
Caution!

Be careful not to damage threads.



Extract front outer bearing race with special tool 33 1 350.

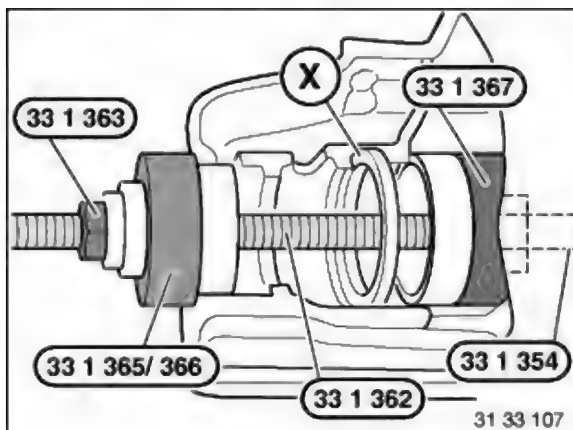
- (1) Spreader
- (2) Front bearing outer race
- (3) Puller bell housing
- (4) Bolt



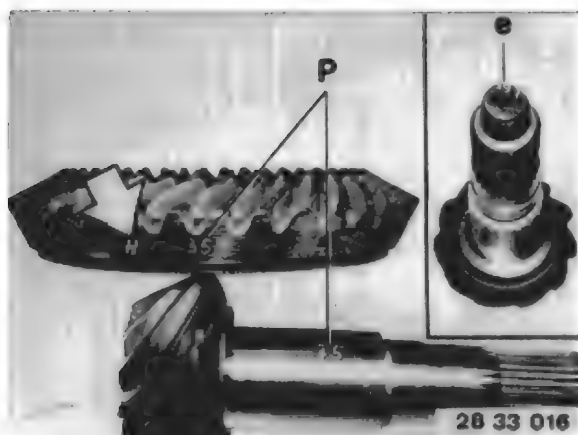
Remove rear outer bearing race with special tool 33 1 360/351/362/356/363.

Caution!

The shim (X) is located below the rear outer bearing race. It will be needed again for pinion/crown wheel adjustments. Measure and note down thickness of shim (X), e.g. X = 4.14 mm.



Install old shim (X) in front of rear outer bearing race. Fit new outer bearing race with special tool 33 1 354 / 362 / 363 / 360 / 365 / 366 / 367.

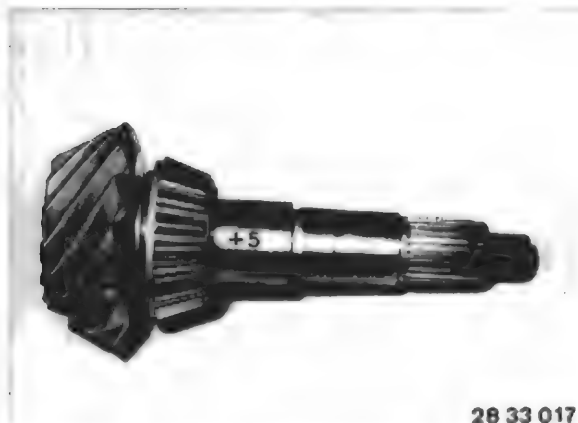


Caution!

Drive pinions and crown wheels are paired for optimal smooth running in special machines.

The pairing code (P) is inscribed electrically on the drive pinion and crown wheel.

Never install crown wheel and drive pinion with different pairing codes (P) together.

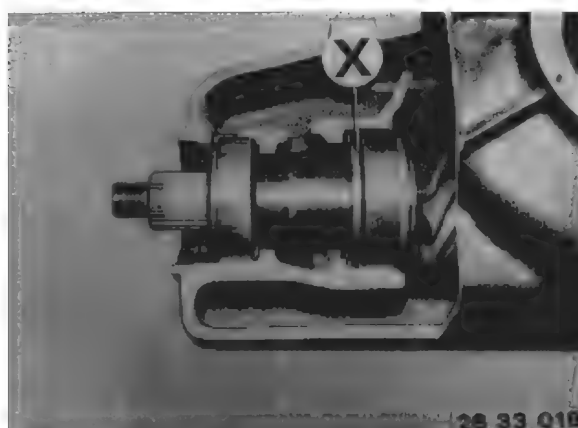


Press taper roller bearing onto new drive pinion with special tool 33 1 330.

The number applied with "+" or "-" is the deviation from basic adjustment dimension C in hundredths of a millimetre and is used for determining the correct thickness of shims.

Note number with prefix (add + e to C or subtract - e from C, refer to example).

H = designation for Gleason gear

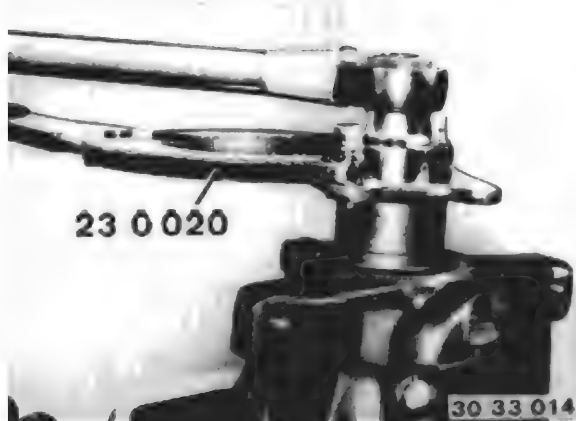


To calculate the correct shim (X), drive pinion is installed with new taper roller bearings but without a clamping bush.



Install drive pinion in the rear bearing outer race.

Twist special tool 33 1 341 (reducer) onto drive pinion and pull front taper roller bearing onto drive pinion with special tool 23 1 300 in conjunction with special tool 33 1 342 (spacer bush).



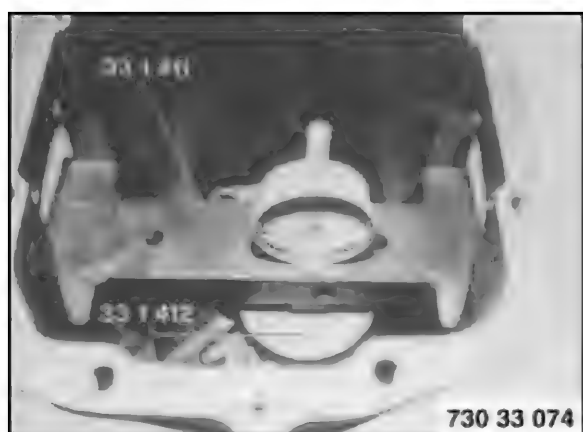
Mount input flange.

By tightening the collar nut, adjust friction torque of input taper roller bearing to 250 Ncm.

Calculate thickness of shim (A).



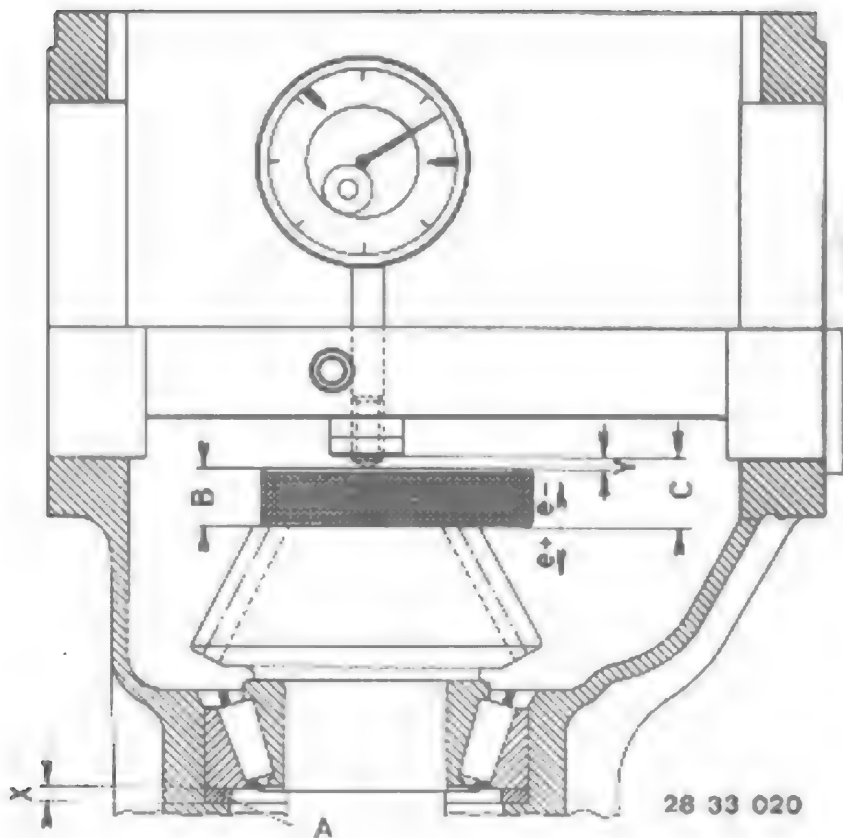
Secure dial gauge to special tool 33 1 411, place on special tool 33 1 412 and adjust dial gauge preload to 0 (zero).



Fitting special tool 33 1 412 to drive pinion. Install special tool 33 1 411 in housing.

Read value (Y) and note down e.g. $Y = 0.60 \text{ mm}$.

Example:



C = 18.50 mm (basic adjustment dimension for all Type G final drives)

B = 17.50 mm (special tool 33 1 412)

- / +e = coefficient of bevel gear e.g. - e 30

Y = measured distance e.g. 0.60 mm

X = old shim e.g. 4.14 mm

A = thickness of correct shim

Establishing correct thickness of shim:

C nominal = C - e = 18.50 mm - 0.30 mm = 18.20 mm

C actual = B + Y = 17.50 mm + 0.60 mm = 18.10 mm

D (difference) = C nominal - C actual = 18.20 mm - 18.10 mm = +0.10 mm

A = X - D = 4.14 mm - (+0.10 mm) = 4.04 mm

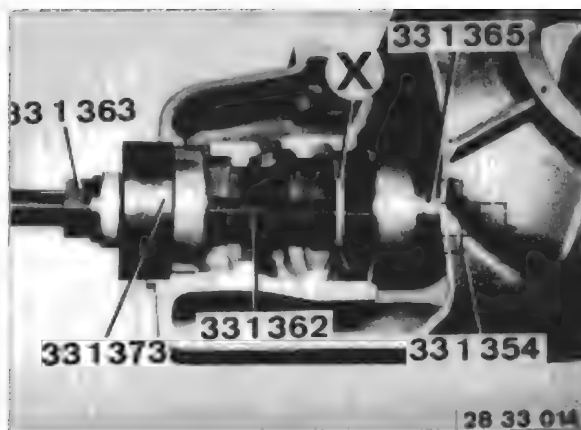
The correct thickness for the shim is 4.04 mm.

Caution!

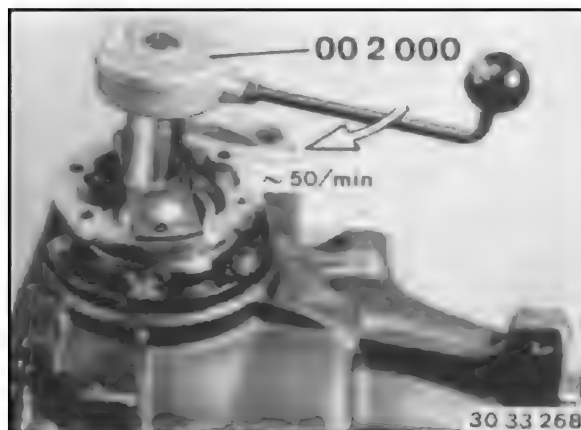
If the difference (D) is positive, the old shim was this much too thick.

If the difference (D) is negative, the old shim was this much too thin.

The permitted tolerance for the shim (A) is derived from the available shim gauges which range from 0.01 ... 0.03 mm.

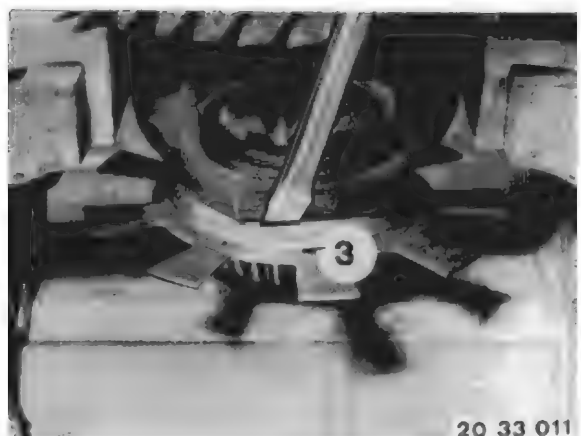


Remove drive pinion and rear bearing outer race.
Press-fit correct thickness of shim (A) and outer bearing race.



Caution!

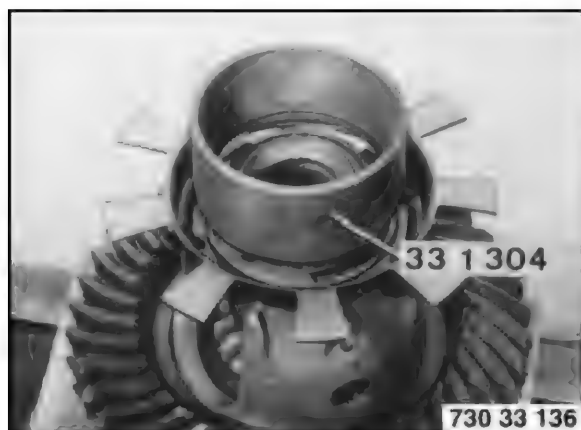
Do not install the drive pinion at this point, since it is first necessary to measure and adjust the friction torque of the new final drive housing bearing.



Press pulse generator wheel (3) off final drive housing.

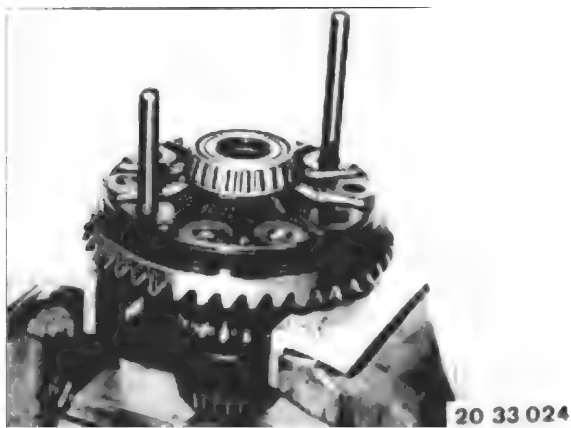
Caution!

Do not bend the pulse generator wheel.



Installation:

Press on pulse alternator wheel with special tool 33 1 304 (union ring).



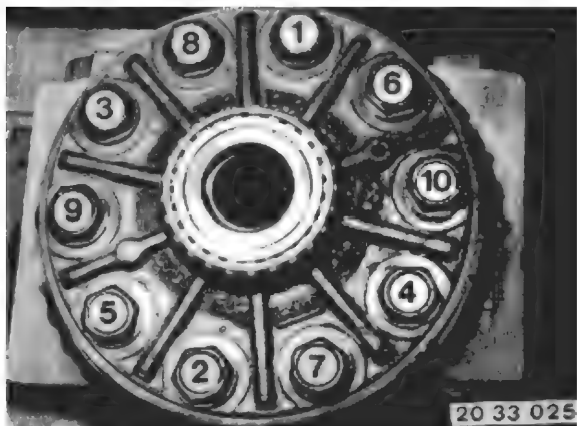
Remove crown wheel (cold).

Installation:

Clean tapped bores thoroughly (tapper).

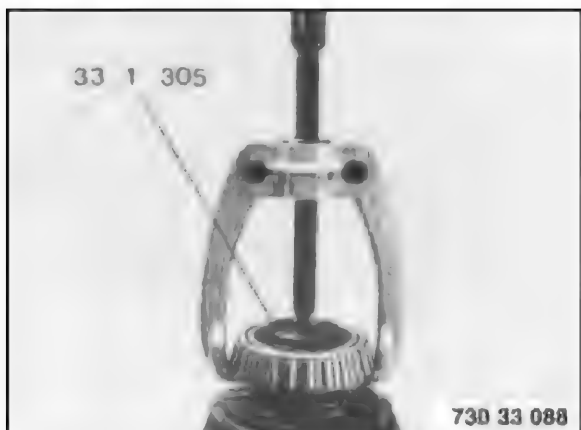
Heat plate spring to max. 100 °C (thermo-chrome pin).

Mount crown wheel with two locally manufactured staybolts for guiding.



Install new screws with Loctite No. 270 and tighten down in sequence (1 ... 10).

Tightening torque,
refer to Technical Data 33 12 1AZ.

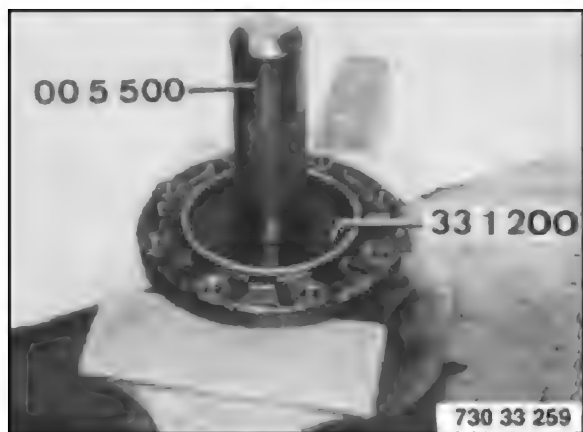


Remove taper roller bearing from recesses on final drive housing with standard extractor tool in conjunction with special tool 33 1 305 (pressure piece).



Installation:

Press-fit new taper roller bearing inner races cold with special tool 33 1 003 (sleeve).

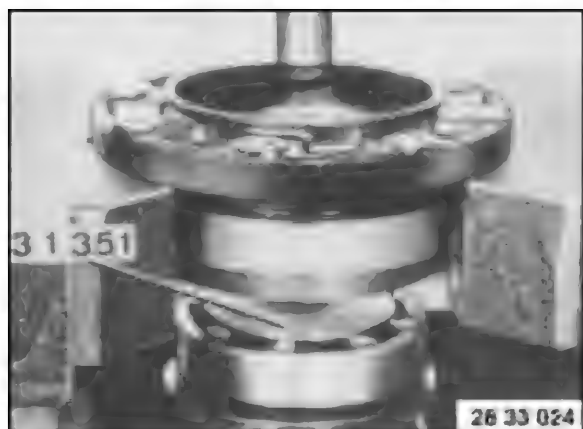


Lift shaft seals out of both bearing caps.

Installation:

Dip new shaft seal in final drive oil.

Drive shaft seals firmly home with special tools 33 1 200 and 00 5 500.



Press out outer bearing race with special tool 33 1 350 / 351.

Caution!

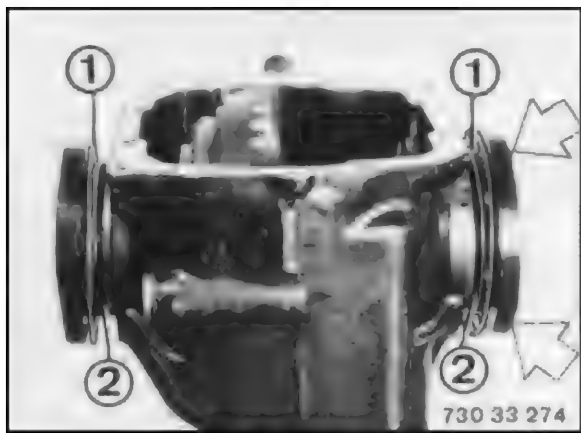
Special tool must engage in the bearing outer race.



Installation:

Press in new outer bearing races with special tool 33 1 365 or 33 1 368 (pressure plate).

The following operations for determining friction torque of the final drive housing bearing are only required if the bearing IS BEING REPLACED.



Determine friction torque of final drive housing bearing:

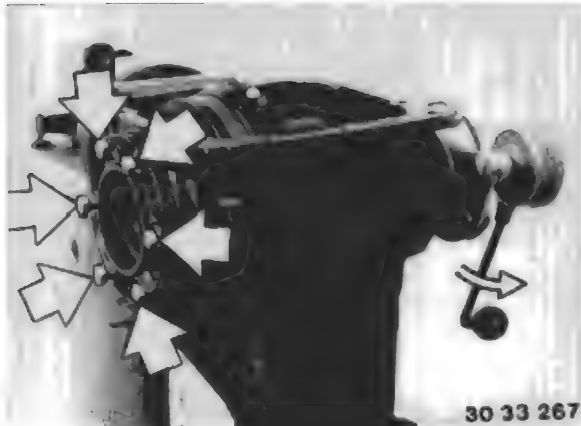
Install final drive housing with new crown wheel and new bearings.

Coat bearing with approved final drive oil, refer to BMW Service Operating Fluids.

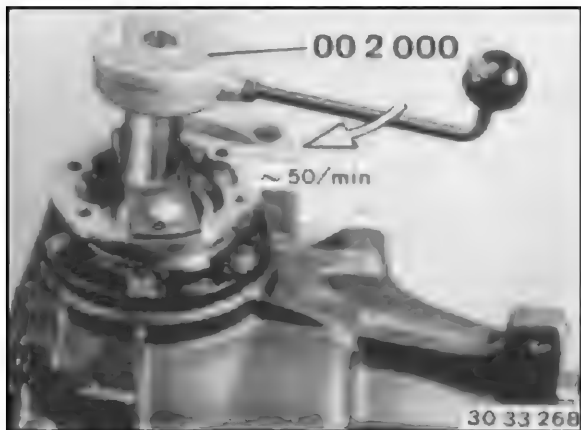
Note designation on side bearing cover, and install with appropriate shims (1), but without O-rings (2).

Tighten down screws on bearing cover beside bevel gear.

Tightening torque,
refer to Technical Data 33 11 2AZ.



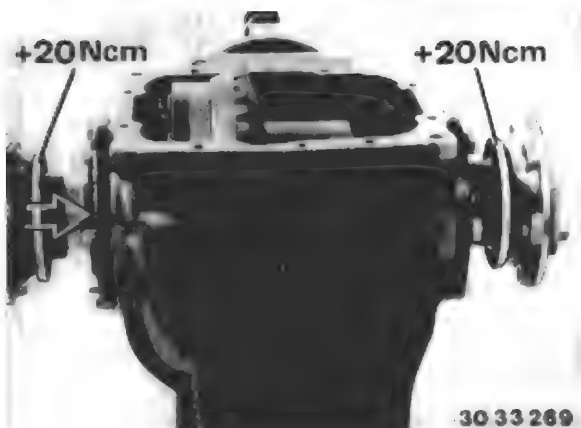
Tighten screws on bearing cover beside bevel gear uniformly to the point where the final drive is still just able to rotate.



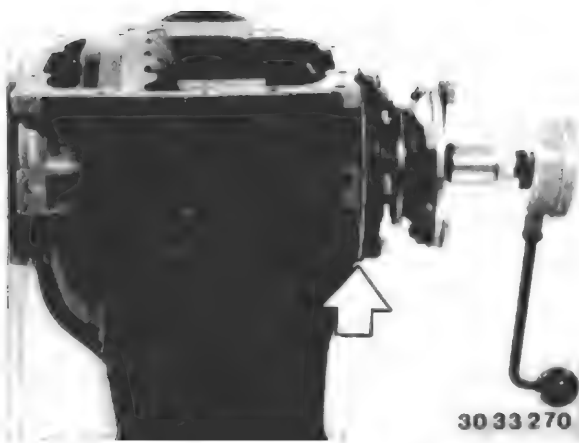
Install an input flange on the bevel gear end.

Using a bracket with welded nut (in-house manufacture) and special tool 00 2 000, calculate the friction torque.

Turn friction torque meter at speed of approx. 50 rpm.



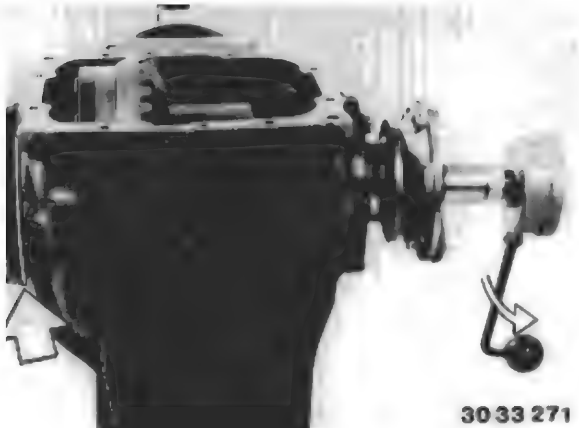
The friction torque specified for the new final drive bearing kit (+20 Ncm for every new shaft seal in which a shaft is rotating during measurement) should be achieved but not exceeded.



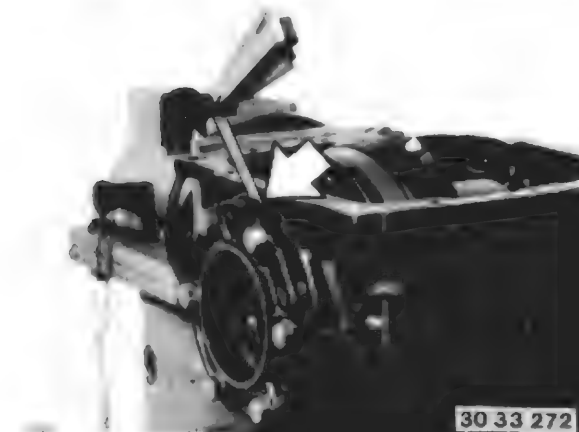
If the specified friction torque is not achieved although both bearing covers have been tightened to the specified tightening torque,

refer to Technical Data 33 11 2AZ,

a thinner shim must be installed at the crown wheel end and the measurement must be repeated.



If the friction torque level is achieved even though the second bearing cover has not been tightened to the specified tightening torque, a thicker shim must be installed at the crown wheel end and the measurement must be repeated.



To simplify calculation of the shim thickness, the distance between shim and transmission case must be measured with a feeler gauge and added to the shim thickness fitted.



Example:

Bearing cover at crown wheel end not tightened down (screws tightened uniformly). Friction torque specified on bearing set packaging 180 Ncm.

1 output flange fitted

New shaft seal = 20 Ncm

Measured friction torque = 200 Ncm

Gap measured with feeler gauge = 0.20 mm

Shim used = 1.40 mm

New shim = 1.60 mm

Install new shims, 1.60 mm gage, and repeat measurement.

Once the friction torque has been established, remove final drive and mark shims used in bearing cover and transmission.



Install bevel gear and shim:

Install drive pinion with a new clamping sleeve (2).

Drive in shaft seal and fit input flange.

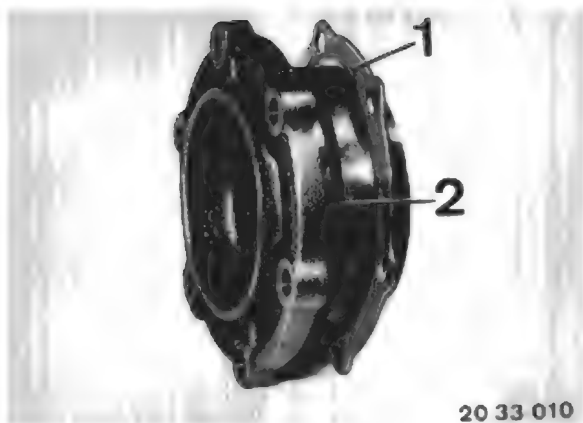


Caution!

Gradually tighten the collar nut (1), measuring the friction torque at regular intervals with special tool 00 2 000 (friction torque gauge). Tighten down the collar nut until the friction torque value specified for the new taper roller bearing plus 20 Ncm for the new shaft seal is reached.

The friction torque level should be reached but must not be exceeded.

If friction torque value is exceeded, replace bushing (2) and repeat measuring procedures.



Install final drive and bearing cover after marking the appropriate shims (1) and installing new O-rings (2): then tighten screws down evenly.

Tightening torque,
refer to Technical Data 33 11 2AZ.



Backlash/Tooth Contact Pattern Adjustment

Secure special tool 00 2 500 and measure torsional face runout,

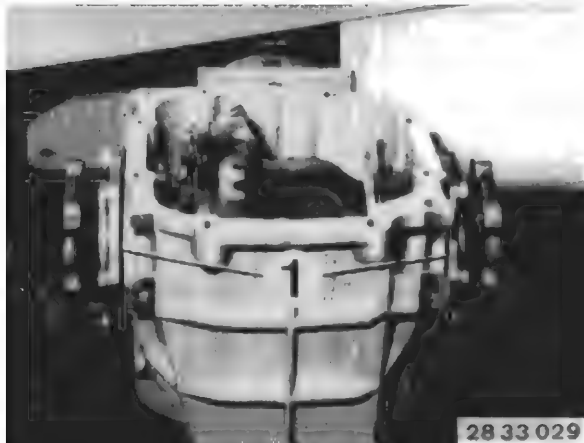
refer to Technical Data.

Caution!

The tooth contact pattern is always most important for a perfectly adjusted pinion/crown wheel.



To check the tooth contact pattern, coat the crown wheel teeth with printer's ink, turn in both directions several times and stop crown wheel suddenly with a piece of hard wood.



Correction of torsional face runout and contact pattern is performed by altering the thicknesses of both shims (1).

If backlash is too great, install a thinner shim on the crown wheel end.

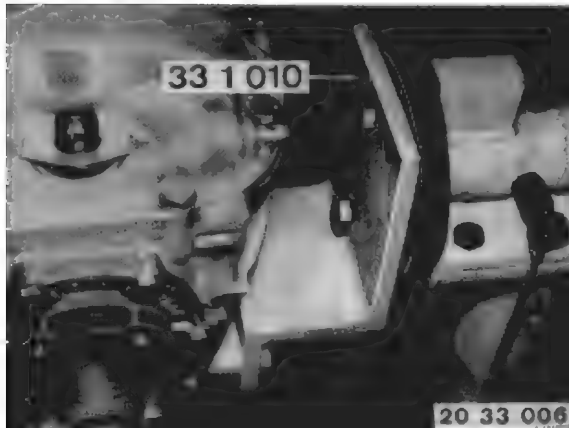
If backlash is too small, use a thicker shim on the crown wheel end.

Axial displacement of the crown wheel of 0.01 mm signifies a change in tooth flank clearance of 0.0076 mm.

Caution!

The total thickness of both shims must not be altered.

If a thinner or thicker shim is required to correct the tooth contact pattern, the total thickness must be corrected with the second shim, since otherwise the friction torque of bearings would be changed again.



Removing and installing final drive, included in MF Workshop Manual, model-dependent, from '85, refer to 33 10 010.

Securing final drive to special tool 33 1 010 (retaining bracket).
Drain ATF. Take off case cover.

Installation:

Replace gasket.

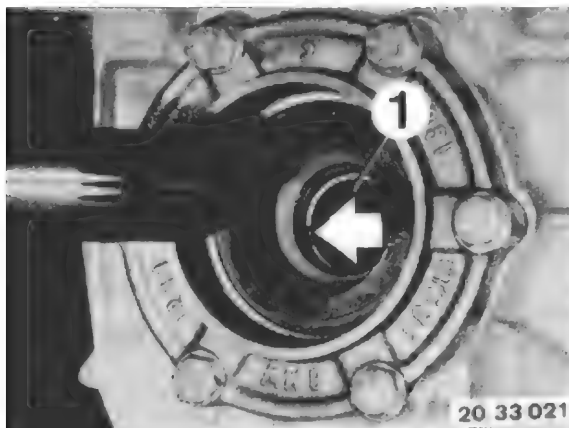
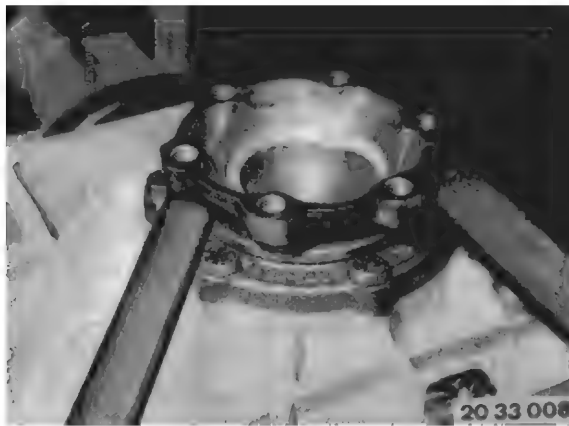
Tightening torque, refer to Technical Data

Add oil.

Oil volume, refer to Technical Data

Refer to Fluids and Lubricants for approved oil.

Press off both drive flanges with a tire iron.



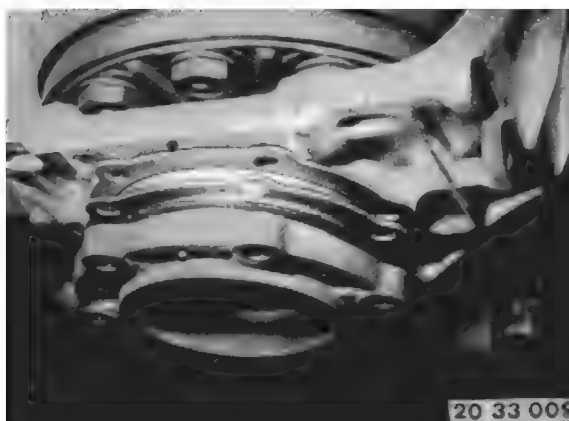
Installation:

Place round wire snap ring (1) in groove of differential case prior to installation of the drive flange, that both ends are recessed in the groove.

This prevents lateral bending of the ring.

Press in drive flange by hand and turn slightly until wire snap ring is heard to engage.

Replace stretched snap rings.



Punch mark both bearing caps.

Unscrew and remove both bearing caps.

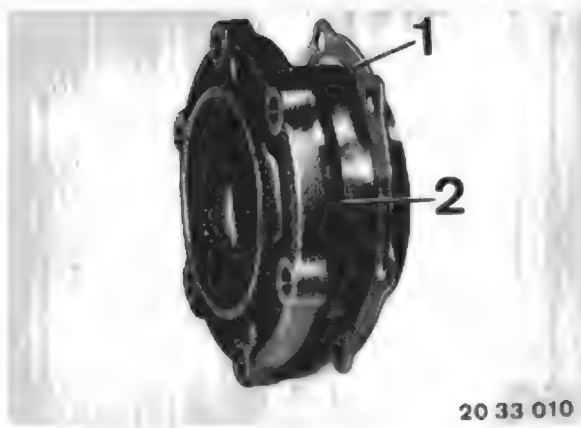
Caution!

Don't mix up bearing caps and spacers.

Secure spacers on bearing cap with a piece of wire, if necessary.

Installation:

Tightening torque, refer to Technical Data



Final drive housing bearings and backlash are adjusted with shims (1).

Check O-ring (2), replacing if necessary.



Remove complete final drive housing.

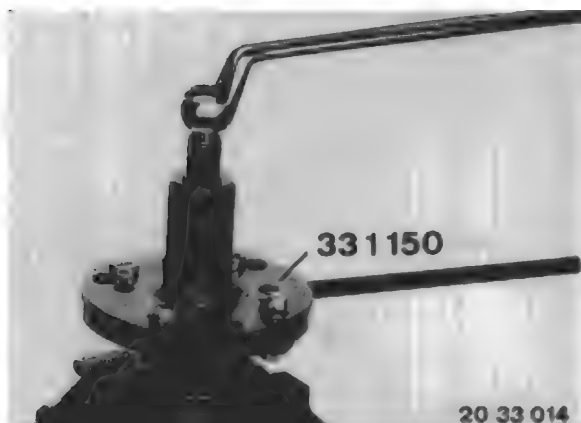
Caution!

Don't bend the pulse spider.



Remove lockplate.

Unfasten nut (1) and brace with special tool 23 0 020.

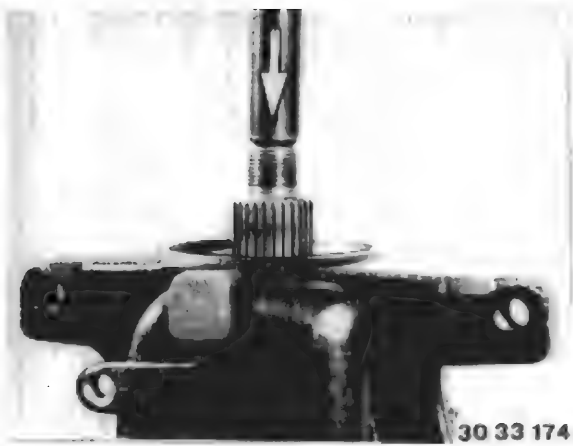


Remove input flange with special tool 33 1 150.

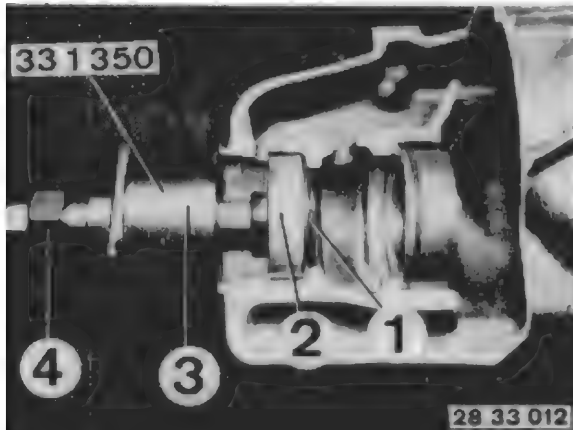
The specified friction torque for the new input bevel gear bearing is indicated,

refer to Technical Data

The friction torque of old bearings does not have to be measured.

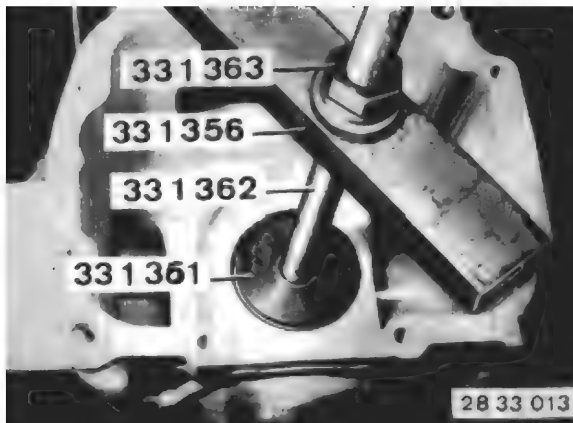


Press out drive pinion.



Extract front bearing outer race with special tool 33 1 350 (fixture).

- (1) Spreader
- (2) Front bearing outer race
- (3) Puller bell housing
- (4) Pressure bolt



Extract rear outer bearing race with special tool 33 1 360 (fixture).

Puller consists of:

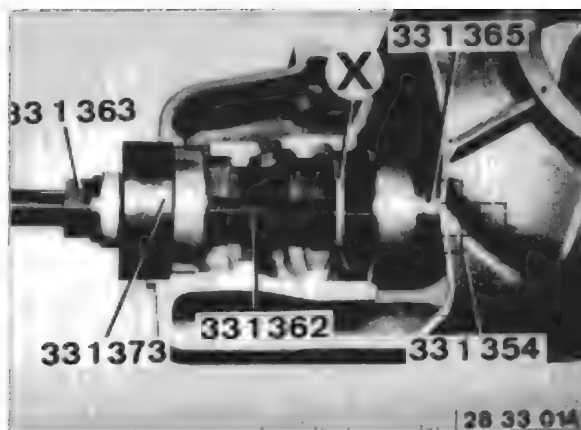
- Special tool 33 1 351 (extractor head)
- Special tool 33 1 362 (threaded spindle)
- special tool 33 1 356 (support bridge)
- Special tool 33 1 363 (pressure nut)

Caution!

Shim (X) is located underneath the rear bearing outer race.
It will be needed again for pinion/crown wheel adjustments.

Caution!

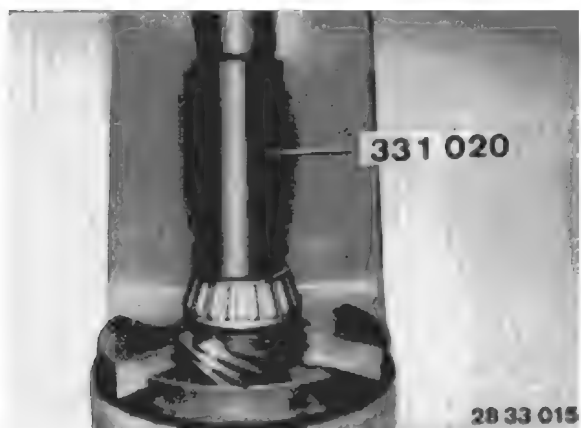
Replace both drive pinion bearings, using only one make.



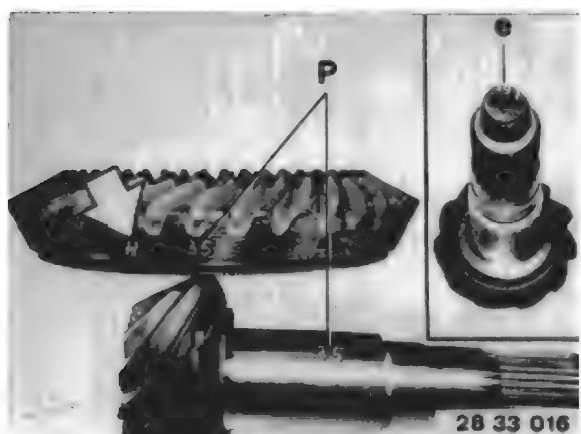
Install old shim (X) in front of the rear bearing outer race.
Install new bearing outer races with special tool 33 1 360 (installation fixture).

Puller consists of:

- Special tool 33 1 373 (puller disc for front outer race)
- Special tool 33 1 365 (puller disc for rear outer race)
- Special tool 33 1 362 (threaded spindle)
- Special tool 33 1 363 (pressure nut)
- Special tool 33 1 354 (nut)



Press-fit new taper roller bearing inner race to new drive pinion using special tool 33 1 020 (sleeve).



Caution!

Drive pinions and crown wheels are paired for optimal smooth running in special machines.

The pairing code (P) is inscribed electrically on the drive pinion and crown wheel.

Never install crown wheel and drive pinion with different pairing codes (P) together.

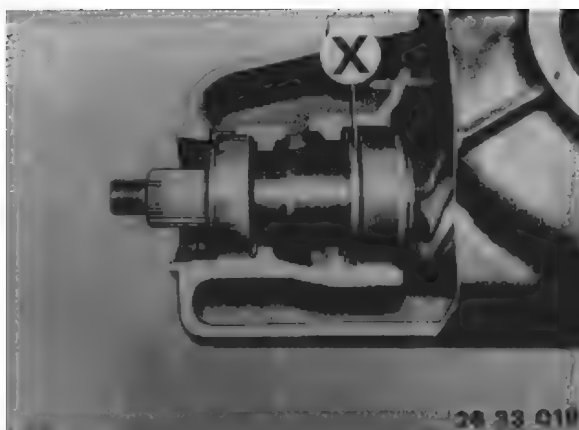
H = Gleason hypoid teeth (helical shape).



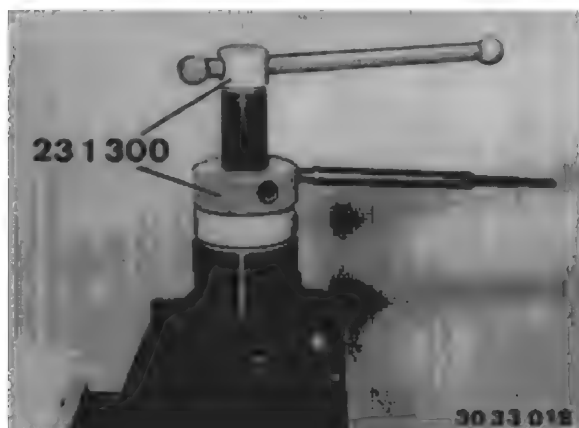
The inscribed number with "+" or "-" is the deviation from basic distance C in hundredths of millimeters and is required for adjustment of the tooth contact pattern with shims.

+ e is added to C.

- e is subtracted from C.



To determine the thickness of shim (X), install drive pinion with new tapered roller bearings, but without bush.



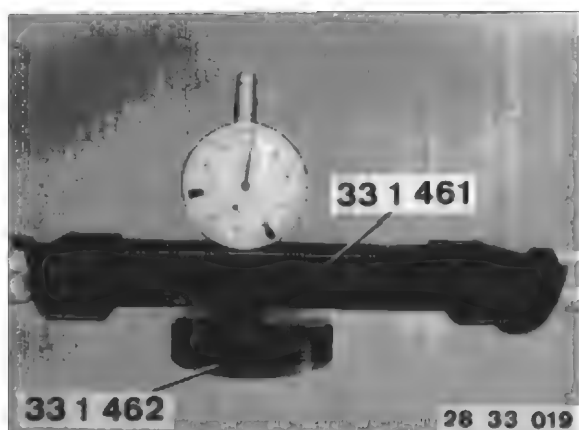
Install drive pinion in the rear bearing outer race.

Press-fit front taper roller bearing to the drive pinion with special tool 23 1 300 in conjunction with a spacer bush but do not tighten down.



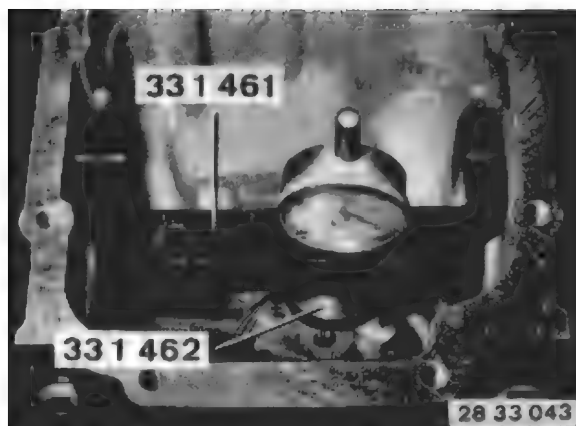
Mount input flange.

Gradually tighten collar nut, occasionally measuring friction torque with special tool 00 2 000 (friction torque gauge) and adjust with collar nut to 250 Ncm.



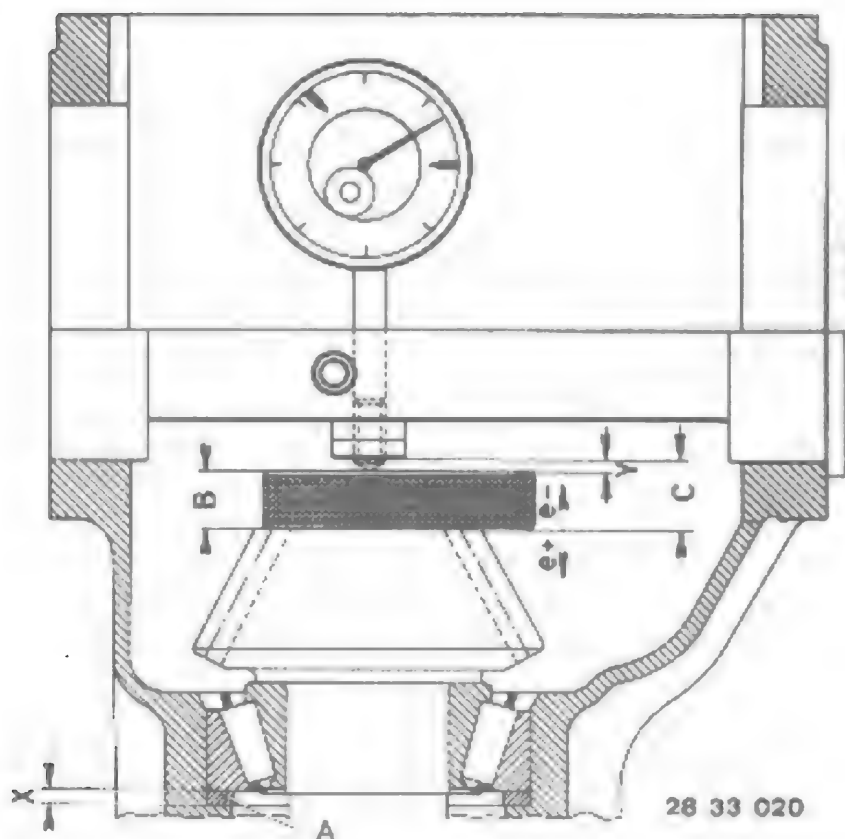
Block Distance of Drive Pinion

Secure dial gauge in special tool 33 1 481 (measuring fixture). Place special tool 33 1 461 (measuring fixture) with dial gauge on special tool 33 1 462 (measuring discs) and set dial gauge with preload at zero.



Fit special tool 33 1 462 (measuring disc) to drive pinion.
 Install special tool 33 1 461 (measuring fixture) in housing.
 Determine value Y.
 Basic distance C = 11.50 mm
 Gage thickness B = 9.50 mm

Examples for Determination of Correct Shim Thickness (X)



Example I:

C	11,50 mm
e +	0,10 mm
C nominal	11,60 mm

Y measured on dial gage	1,90 mm
+ gage thickness B	9,50 mm
C actual	11,40 mm

C nominal	11,60 mm
C actual	- 11.40 mm
a	0,20 mm
Master disc A	4,10 mm
- a	0,20 mm
Thickness of shim (X)	3,90 mm

If C nominal is greater than C actual, "a" is subtracted from thickness of shim (X).

Example II:

C	11,50 mm
e -	0,10 mm

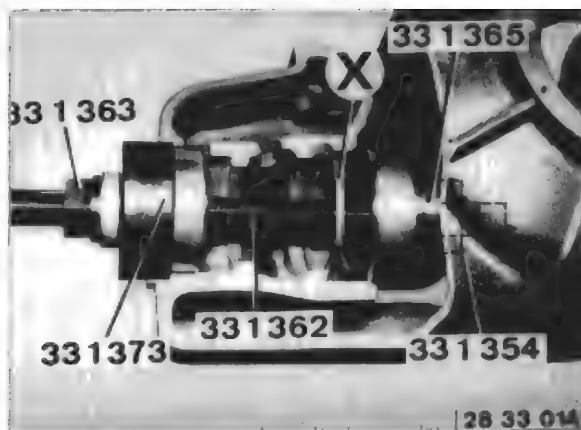
C nominal	11,40 mm
-----------	----------

Y measured on dial gage	2,20 mm
+ master disc thickness	9,50 mm
C actual	11,70 mm

C nominal	11,70 mm
C actual	- 11,50 mm
a	0,20 mm
Master disc A	3,90 mm
- a	0,20 mm
Thickness of shim (X)	4,10 mm

If C Nominal is less than C Actual, "a" on the shim ring (x) is added to the value.

The permitted tolerance for dimension (x) is derived from the gage steps available for shim rings (0.01 ... 0.03 mm)

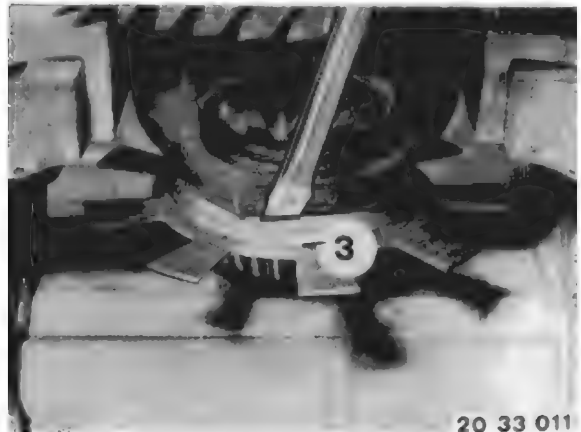


Remove drive pinion and rear bearing outer race.

Press in shim (X) of determined thickness and bearing outer race.

Caution!

Do not install the drive pinion at this point, since it is first necessary to measure and adjust the friction torque of the new final drive housing bearing.



Press pulse spider (3) off of final drive housing.

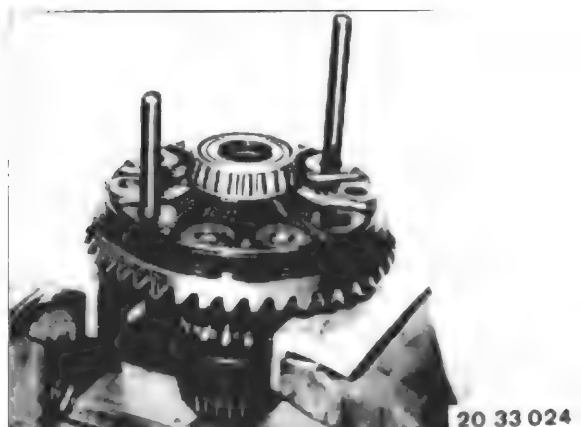
Caution!

Don't bend the pulse spider.



Installation:

Press fit pulse generator wheel with special tool 33 1 358 (pressure sleeve).



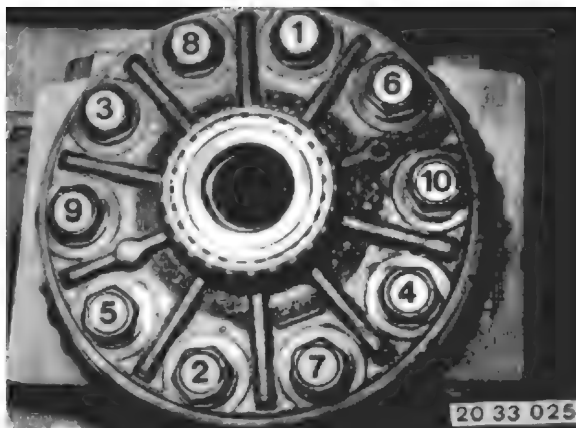
Remove crown wheel (cold).

Installation:

Clean tapped bores thoroughly (tapper).

Heat plate spring to max. 100° C (thermo-chrome pin).

Mount crown wheel with two locally manufactured staybolts for guiding.



Install new bolts with Loctite No. 270 and tighten in order of (1 ... 10)

Tightening torque and torque angle, refer to Technical Data



Extract taper roller bearing on final drive housing with special tool 33 1 300 (extractor).

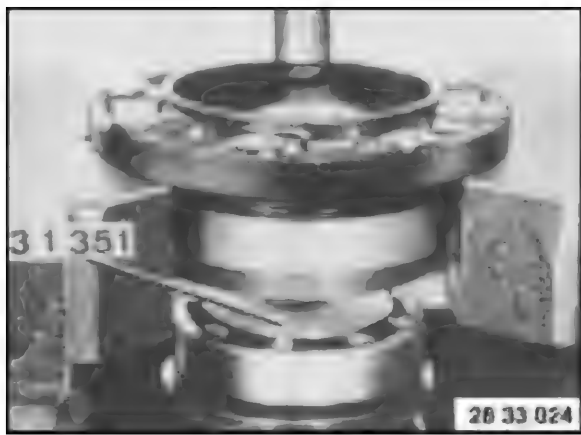


Installation:

Press-fit new taper roller bearing inner races cold with special tool 33 1 003 (sleeve).



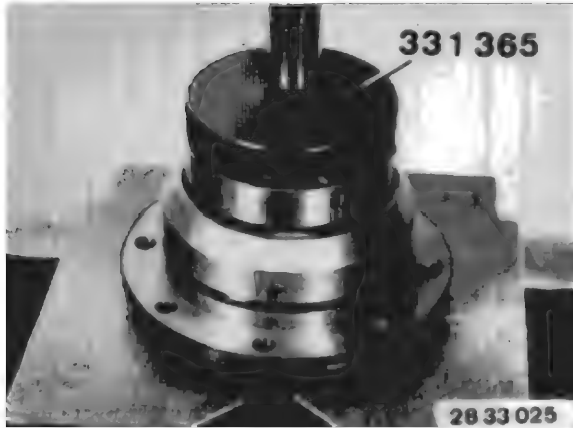
Lift shaft seals out of both bearing caps.



Press out outer bearing race with special tool 33 1 350 (extractor fixture) and special tool 33 1 351 (extractor star tool).

Caution!

Special Tool must engage in the bearing outer race.



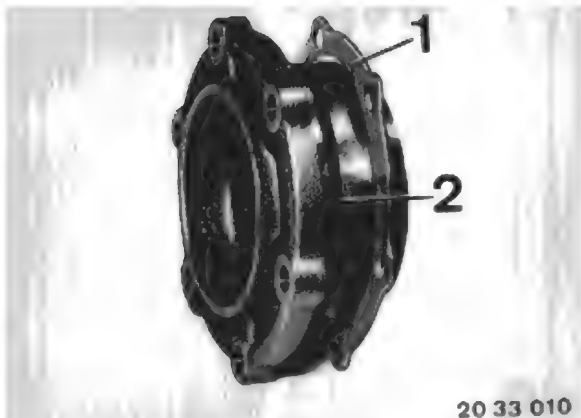
Installation:

Press-fit new bearing outer races with special tool 33 1 365 (pressure plate).

The following 12 steps can only be omitted, if the final drive housing bearings were not replaced.

Install final drive housing with new crown wheel and new bearings.

Lubricate bearings thoroughly with approved final drive gear lube (refer to Fluids and Lubricants) and let them drip dry.



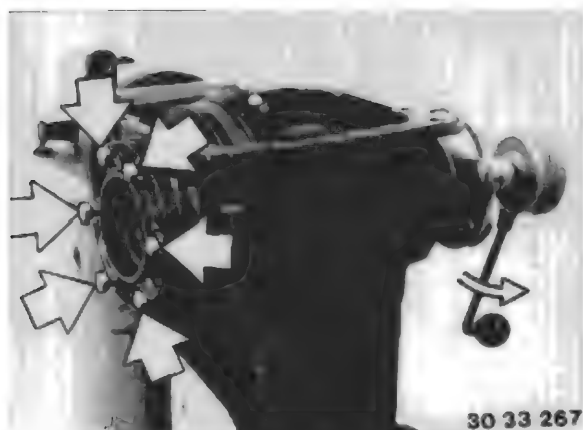
Install side bearing caps marked with belonging shims (1), but at first without O-rings (2).

Evenly tighten bearing cover screws opposite the crown wheel.

Tightening torque, refer to Technical Data

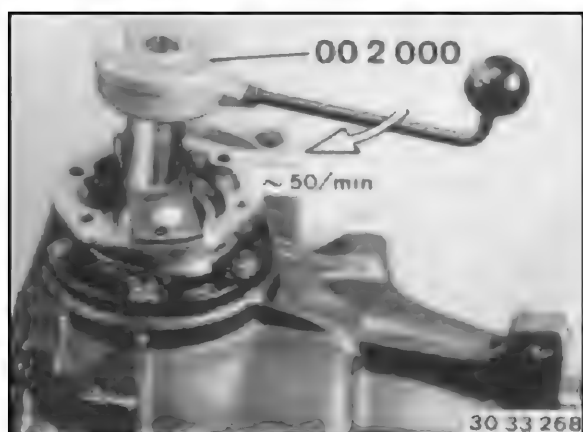


The compensating bore (1), recognized on the outside by tab (2), always faces up in installed position of the transmission.



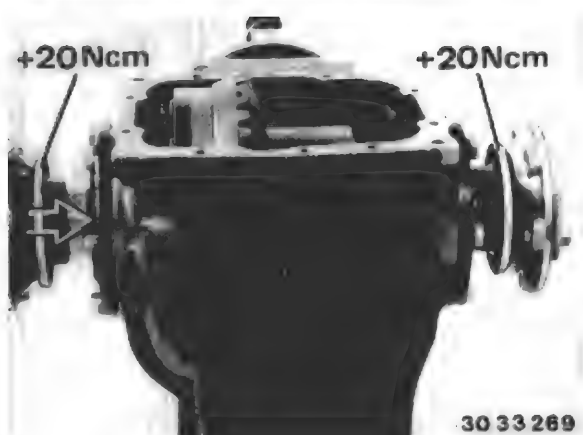
Determining Friction Torque of New final drive housing Bearings
Axial preload force of final drive housing bearings (4000 N) can be determined with help of the friction torque, refer to Technical Data

Tighten bolts of second bearing cap uniformly only enough, that the differential can still be turned easily.



Install an output flange on the side opposite the crown wheel. Determine friction torque using a bracket with welded on nut (in-house manufacture) and special tool 00 2 000 (friction torque gauge).

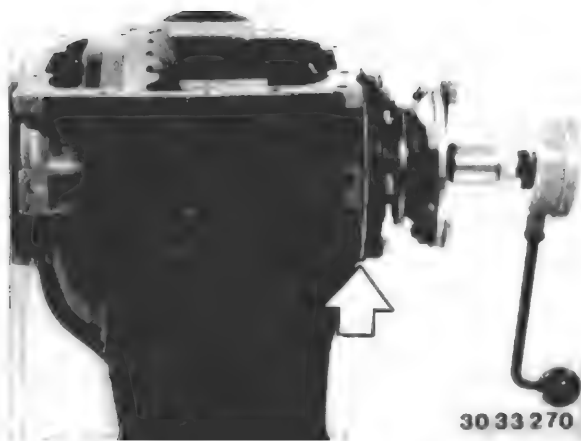
Turn friction torque meter at speed of approx. 50 rpm.



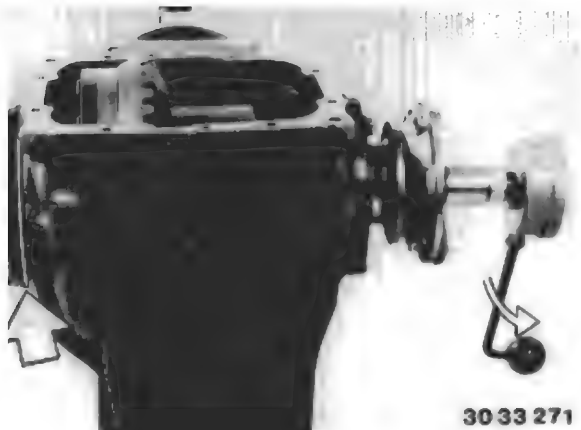
The friction torque specified in the final drive housing bearing table should be reached, but not exceeded (refer to Technical Data).

If new shaft seals have already been fitted, 20 Ncm must be added to each seal in which an output shaft rotates during the measurement process.

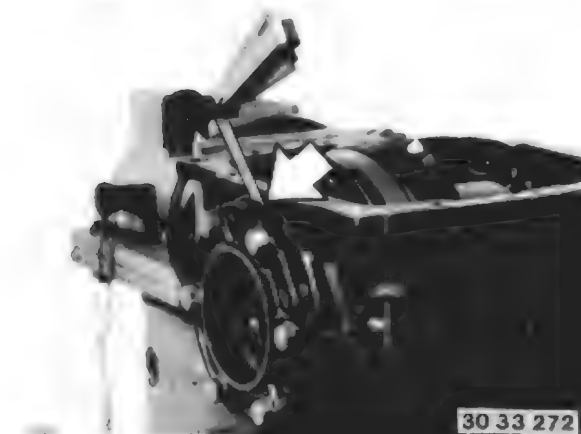
refer to Technical Data



If the given friction torque is not reached, even though both bearing caps are tightened to the correct tightening torque (refer to Technical Data), install a thinner shim opposite the crown wheel and repeat the measuring procedures.



If the friction torque is reached, even though the second bearing cap has not yet been tightened to the correct tightening torque (refer to Technical Data), a thicker shim must be used on the crown wheel end and the measuring procedures repeated.



To make finding the shim thickness easier, the distance between the shim and case can be measured with a feeler gage blade and added to the thickness of the used shim.



Example:

Second bearing cap not tightened (bolts screwed in uniformly)
Specified friction torque reached and shaft seals not yet installed,
refer to Technical Data.

Gap measured with blade	0,20 mm
Used shim	1,40 mm
Install shim of thickness	1,60 mm

Install new shims, 1.60 mm gage, and repeat measurement.

Remove differential for installation of the drive pinion.

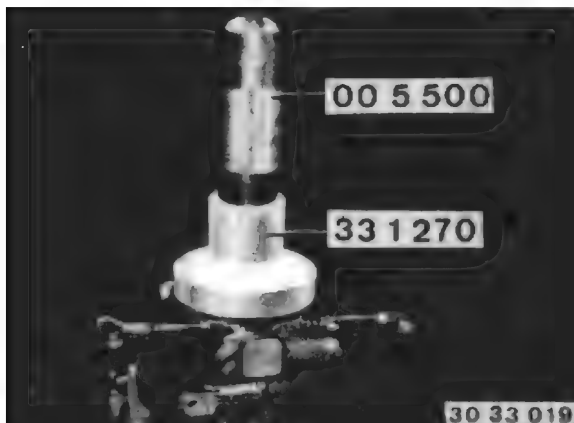
(If final drive housing bearings were not replaced, procedures can be continued from this point.)

Caution!

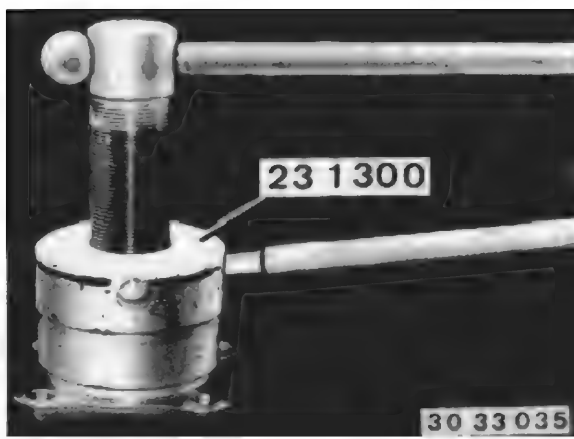
Match side covers ad corresponding shims of determined thickness; don't mix them up.



Install drive pinion with a new clamping sleeve (2).

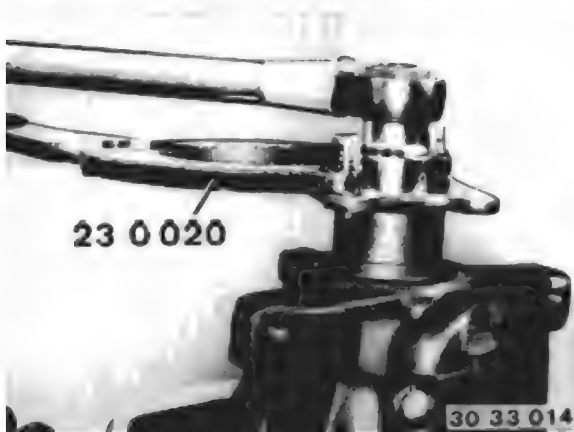


Immerse shaft seal in final drive oil and drive home flush with special tool 33 1 270 in conjunction with special tool 00 5 500 (handle).



Press-fit input flange to the input shaft using special tool 23 1 300 but do not tighten down.

The axial preload force of drive pinion bearings (5000 N) can be determined with help of the friction torque.



Tighten input flange with the collar nut in steps, measuring the friction torque after each step.

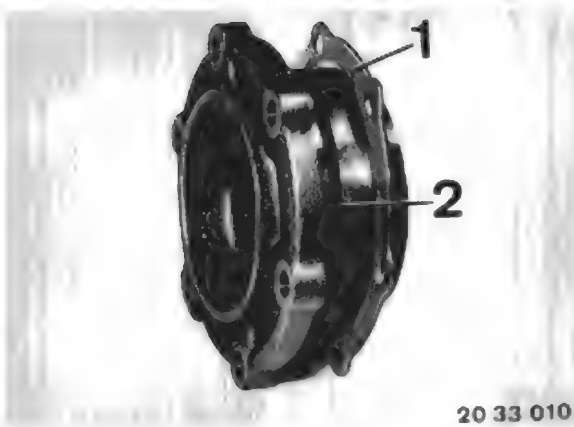


Measure friction torque with special tool 00 2 000 and suitable socket head, refer to Technical Data.

Caution!

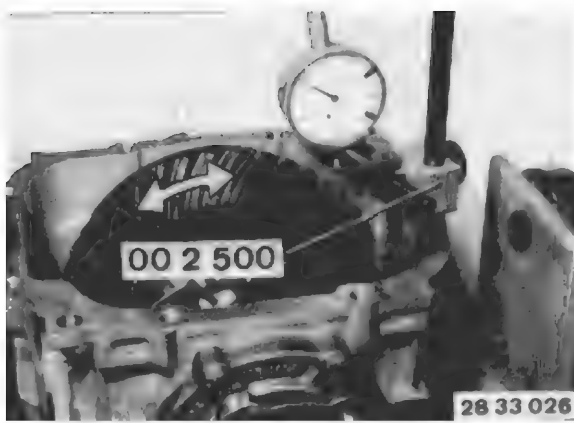
The relation between friction torque and preload force differs depending on the make of bearings.

Take specified friction torque from the pinion bearing table and add 20 Ncm, refer to Technical Data.



Install differential. Install side covers as marked with corresponding washers (1) and new O-rings (2). Tighten bolts uniformly.

Tightening torque, refer to Technical Data



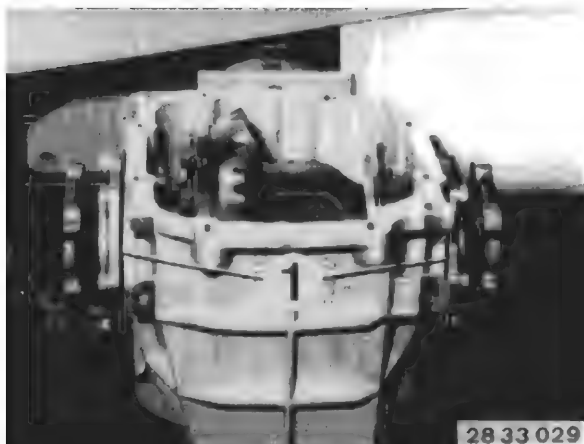
Backlash/Tooth Contact Pattern Adjustment
 Attach special tool 00 2 500 (dial gauge holder) and measure torsional face runout, refer to Technical Data

Caution!

The tooth contact pattern is always most important for a perfectly adjusted pinion/crown wheel.



To check the tooth contact pattern, coat the crown wheel teeth with printer's ink, turn in both directions several times and stop crown wheel suddenly with a piece of hard wood.



Correction of torsion clearance, refer to Technical Data

and contact pattern is performed by altering the thickness of both shims (1).

If the backlash is too large, install a thinner shim on the crown wheel end.

If backlash is too small, use a thicker shim on the crown wheel end.

Axial displacement of the crown wheel of 0.01 mm signifies a change in tooth flank clearance of 0.0076 mm.

Caution!

The total thickness of both shims must not be changed.

If a thinner or thicker shim is required to correct the tooth contact pattern, the total thickness must be corrected with the second shim, since otherwise the friction torque of bearings would be changed again.

Installation:

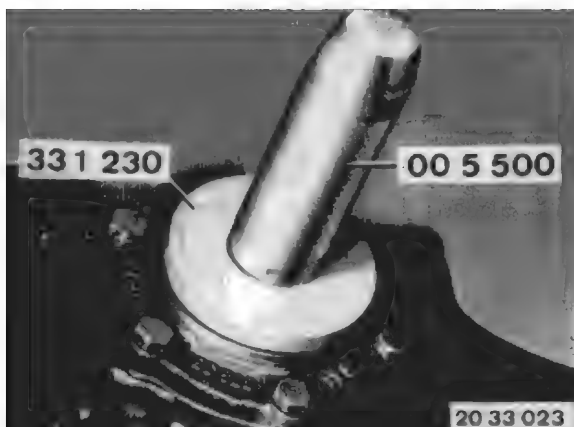
Dip new shaft seals in final drive gear lube.

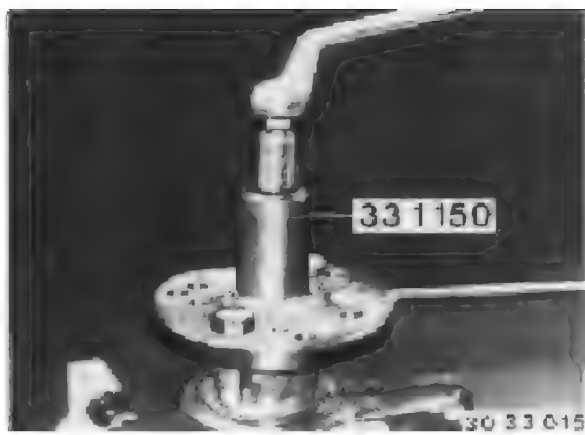
Drive shaft seal firmly home with special tool 33 1 230 (impact bush) in conjunction with special tool 00 5 500 (handle).

Replace drive flange if the bearing surface is seriously scored.

Note:

It is possible that the special tool 33 1 230 might have to be reworked to compensate for casting tolerances on the side cover.





Drive in new retaining plate with special tool 33 4 050 and special tool 00 5 500 (handle).

Final drive fluids changeover

All models with option 209

- Subject:** A new approved fluid is being made available for all final drives with limited-slip differential (option 209) in connection with the introduction of the Z3 Roadster. The new fluid is called "BMW Hinterachsgetriebeöl Synthetik MSP/A" (BMW final drive fluid synthetic MSP/A) and it will replace "BMW Hinterachsgetriebeöl MSP" (BMW final drive fluid MSP).
- Effect:** It is not permitted under any circumstances to fill up the final drive on a Z3 Roadster with limited-slip differential with MSP fluid. It is **imperative** that MSP/A is used in this instance, as if the wrong type of fluid is used, creaking noises can be heard when the vehicle is in motion.
- Procedure:** The final drives should be filled with the prescribed fluid.
Any MSP fluid dealers may still have can be used up on any model except for the Z3 Roadster.
- Parts:** **Hypoid fluids for final drives with plate-design self-locking limited-slip differential**
- BMW final drive fluid synthetic MSP/A
- | | |
|--------------|-----------------|
| 55 l barrel | 83 22 9 407 870 |
| 205 l barrel | 83 22 9 407 871 |
- Castrol SAF-XJ
 - Veedol SAF 44

33 13 Differential E34

Friction torque on differential casing bearings (both), according to differential type (see front) and bearing manufacturer. Note: Thouroughly lubricate bearings with differential lubricant, allow excess to drip off.		
Type K FAG	Nm	1.18 - 2.62
Type K SKF	Nm	1.20 - 2.40
Type K Timken	Nm	1.28 - 2.60
Type K Koyo	Nm	1.20 - 2.62
Type M FAG	Nm	1.10 - 2.44
Type M SKF	Nm	1.00 - 2.00
Type M Timken	Nm	0.70 - 2.56
Type M Koyo	Nm	1.40 - 2.60
Type G Timken	Nm	1.80 - 3.80
Type G Koyo	Nm	1.40 - 3.40

33 12 Drive Pinion and Backlash E34

Backlash	mm	0.06 to 0.14 (0.0024 to 0.0055)
Backlash Vehicles with M60 B40	mm	0.04 ... 0.10
Ring gear installing temperature	°C	80 ... 100
Max. input flange radial runout	max. mm	0.07
Approx. shaft seal friction torque	approx. Nm	0.20

33 14 Final Drive with Limited Slip Differential E34

Slip torque with one differential side gear held tight and one driven (plates lubricated with approved final drive gear lube)	Nm	50 ... 75
Optional outer plate thickness	mm	1.9 / 2.0 / 2.1
Inner plates	mm	2.0

00-1

Tightening Torque Reference Values

Applicable only for shank bolts with standard and fine metric threads to DIN 13, sheet 13, and nuts with a nut height of $0.8 \times d$ to DIN 934 and exclusively for μ total = 0.125 (bolt phosphated, nut without surface treatment or galvanized; lubricated state: not lubricated or also lubricated with oil).

The tightening torque for cadmium-plated bolts or nuts (μ total = 0.08 to 0.09) must be - 30 % less than that in the table when the degree of bolt material exploitation is the same.

The values given in this table are applicable to bolted connections conforming with the conditions described above.

Not applicable with use of different surface treatment or lubricated state of threads as well as with deviating nut height.

Not applicable for bolts with expansion shanks, self-locking bolts or nuts as well as for the bolting together of parts made of different materials.

Threads	Max. Tightening Torque Msp (Nm)							
	Property Class to DIN 267							
	5.6	5.8	5.6	6.8	6.9	8.8	10.9	12.9
M 4	1.3	1.8	1.6	2.1	2.4	2.9	4.1	4.9
M 5	2.7	3.6	3.2	4.3	4.8	5.9	8.3	10
M 6	4.7	6.2	5.6	7.5	8.4	9.9	14	16.5
M 8	11	15	14	18	20	24	34	40
M 8 x 1	12	16	14.5	19.5	22	26	36	44
M 10	23	30	27	36	40	47	66	79
M 10 x 1	25	34	30	40	45	54	75	91
M 12	39	52	47	62.5	70	82	115	140
M 12 x 1.5	41	54.5	49	65.5	73.5	87	123	147
M 14	62	82.5	74.5	99	110	130	180	220
M 14 x 1.5	67	89.5	80.5	107	120	143	200	240
M 16	94.5	126	113	150	170	200	280	340
M 16 x 1.5	101	135	121	162	182	216	303	364
M 18	130	174	166	209	235	280	390	470
M 18 x 1.5	147	195	176	234	264	313	440	527
M 20	184	245	220	295	330	390	550	660
M 20 x 1.5	204	272	245	326	367	435	612	734

Extracted from BMW Standard N 600 02.0

11-1 Engine		Type	Nm
11 11	Engine block		
1AZ	Main bearing cap bolts* Cleaned and lubricated	M10 M10 / M20 / M30	60
		M21	65
		M88-3 / S38 / S14 / M40 / M43 M42 / M50 / S50 / M51	1. Initial torque 20 2. Turn additional 50°
2AZ	Main bearing cap bolts* Do not remove coating from bolts	M70 / M60 / S70	1. Initial torque 20 2. Turn additional 70°

* Assemble engine with new bolts

11 - 2 ENGINE		Type		Nm
11 11	Engine Block			
3AZ	Main bearing cap Inclined bolts Collar bolts** or spacer bolts	M8	M60	1. 20 Nm torque 2. 45° torque angle
	Hex. head bolts	M8 10.9	M70 / S70	34 **
	Threaded support sleeves		M70 / M60 / S70	10
4AZ	Struts/bracing shell	M10	All	43
		M8	All	22
5AZ	Coolant drain plug In crankcase	M12x1.5	All	30
		M14x1.5	M70 / S70 / M60	28
			All others	40
6AZ	Main oil bore plugs	M16x1.5	All	34

** When repairing replace hexagon head bolts with washers against collar bolts.

11 - 3 ENGINE			
		Type	Nm
11 12	Cylinder head and Cover		
1AZ	Cylinder head bolts *	M10	1. 60 NM torque 15 minute settling time 2. $33 \pm 3^{\circ}$ torque angle 25 minute warm- running time 3. $25 \pm 5^{\circ}$ torque angle

* Replace, wash and oil cylinder head bolts.

11 - 4 ENGINE		Type		Nm
11 12	Cylinder Head and Cover			
2AZ	Cylinder head bolts *	M10	M20	1. 40 + 5 Nm torque 15 minute settling time 2. 60 + 5 Nm torque 25 minute warm-running time 3. 25 + 5° torque angle
	Hexagoh head bolt **			
	Torx head bolt **	M10	M20	1. 30 Nm torque 2. 90° torque angle 3. 90° torque angle No settling time No warm-running time

- * Replace, wash and oil cylinder head bolts.
- ** When repairing, only use Torx head bolts.

11 - 5 ENGINE

	Type	Nm
11 12 Cylinder Head and Cover		
3AZ Cylinder head bolts *	M21	1. 50 + 10 Nm torque 2. 90 ± 5° torque angle for bolts 1-10 73 ± 3° torque angle for bolts 11-14 15 minute warm-running time 3. 90 ± 5° torque angle
4AZ Cylinder head bolts *	M30	1. 60 ± 2 Nm torque 20 minute settling time 2. 80 ± 2 Nm torque 25 minute warm-running time 3. 35 ± 5° torque angle

* Replace, wash and oil cylinder head bolts.

11-6 Engine

		Type	Nm
11 12	Cylinder head and cover		
5AZ	Cylinder head bolts*	M11 M51	<ol style="list-style-type: none"> 1. Initial torque 80 2. Loosen all bolts 1/2 turn 3. Initial torque 50 4. Turn additional 90° 5. Turn additional 90° Run engine 25 min. 6. Turn additional 90°
6AZ	Cylinder head bolts*	M10 M11 M40 / M42 / M43 / M50 S50	<ol style="list-style-type: none"> 1. Initial torque 30 2. Turn additional 90° 3. Turn additional 90°

* Replace, clean and lubricate cylinder head bolts

11 - 7 ENGINE		Type		Nm
11 12	Cylinder Head and Cover			
7AZ	Cylinder head bolts *	M10	M70	1. 30 Nm torque 15 minute settling time 2. 120° torque angle
	Hexagon head bolt **			
	Torx head bolt **	M10	M70 / S70	1. 30 Nm torque 2. 120° torque angle
8AZ	Cylinder head bolts *	M10	M60	1. 30 ± 2 Nm torque 2. 80° torque angle 3. 80° torque angle

- * Replace, wash and oil cylinder head bolts.
- ** When repairing, only use Torx head bolts.

11 - 8 ENGINE			
		Type	Nm
11 12 Cylinder Head and Cover			
9AZ Cylinder head bolts *	M12	M88-3 / S38 B35 / S14	1. 50 Nm torque 2. 80 Nm torque 15 minute settling time 3. 100 Nm torque
10AZ Cylinder head bolts *	M12	S38 B36 / S38 B38	1. 20 Nm torque 2. 60° torque angle 3. 70° torque angle

* Replace, wash and oil cylinder head bolts.

11 - 9 ENGINE		Type		Nm
11 12	Cylinder Head and Cover			
11AZ	Cylinder head cover	M6	All	10
		M7	All	15
		M8	M21	15
12AZ	Oil trap to cylinder head cover	M8	M21	17
13AZ	Timing case to cylinder head	M7	All	15
		M8	All	20

11 - 10 ENGINE				Type		Nm
11 13	Oil Pan					
1AZ	Oil drain plug					
	Wrench size 17 mm	M12x1.5	All			35
	Wrench size 19 mm	M22x1.5	All			60

11-11 Engine

			Type	Nm
11 14	Housing covers			
1AZ	Timing chain cover, upper and lower	M6	all	10
		M8	all	22
		M10	all	47
2AZ	Front/rear end cover to engine block	M6	all	10
		M8	all	22
3AZ	Studs to timing chain cover	M51		65

11-12 Engine		Type	Nm
11 22	Flywheel		
1AZ	Flywheel to crankshaft	M40 / M42 / M43 M51 Automatic	120 *
		M60 manual transmission	105 **
		all others	105 *

* Assemble with new microencapsulated bolts.

** T50 Torx bolts for dual mass flywheel
Do not use bolt locking fluid.
Bolts form an integral part of the flywheel.
Lubricate threads of bolts.

11 - 13 ENGINE		Type	Nm
11 23	Vibration Damper		
1AZ	Pulley to crankshaft	M10	190
2AZ	Vibration damper hub to crankshaft *		
	M18x1.5	M20 / M21 / M50	410
	M24x1.5	M30 / M88-3 / S14 / S38 B35	440
	M18x1.5	M51 / M60 / M70 / S70	1. 100 + 10 Nm torque 2. 60° torque angle 3. 60° torque angle 4. 30° torque angle
	M20x1.5	S38 B36	1. 150 Nm torque 2. Loosen 3. 60 Nm torque 4. 60° torque angle 5. 60° torque angle 6. 30° torque angle
	M12x1.5	S38 B38 / S50 B30	1. 60 Nm torque 2. 50° torque angle 3. 50° torque angle
* Replace bolts.			

11-14 Engine

11-14 Engine		Type	Nm
11 23	Harmonic balancer		
3AZ	V-belt pulley and harmonic balancer at hub 10.9 M8 bolt M8	S38 B36 / S38 B38 all others	34 22
4AZ	V-belt pulley to harmonic balancer 8.8 M8 bolt	S38 B36 /S38 B38 /S50 B30	22
5AZ	Toothed-belt pulley with hub/ hub to crankshaft* M16x1.5	M40 M42 / M43	310 330

* Use new bolts for assembly

11-15 Engine

		Type	Nm
11 24	Connecting rods and bearings*		
1AZ	Rod bolts*	M10 / M30	55
		M20 / M21 / M40 / M42 / M43 M50 / M51 / M70 / S70	1. Initial torque 20 2. Turn additional 70°
		M60	1. Application torque 5 2. Initial torque 20 3. Turn additional 80°
		M88-3	1. Initial torque 30 2. Turn additional 50°

* Replace, clean and lubricate rod bolts

11 - 16 ENGINE		Type	Nm
11 24	Connecting Rods and Bearings		
1AZ	Conrod bolts *	S14 / S38 B35 / S38 B36 S38 B38	1. 15 Nm torque 2. 30 Nm torque 3. 60° torque angle
		S50 B30	1. 20 Nm torque 2. 65° torque angle

- * Replace, wash and oil conrod bolts.

11-17 Engine

				Type	Nm
11 28	Poly-V-belt with tensioner and idler pulley				
1AZ	Idler lever to alternator bracket	M10 * 10.9	M43		90

* Use new bolt for assembly

11-18 Engine

			Type	Nm
11 31	Camshaft			
1AZ	Camshaft bearing cap	M6	all	10
		M7	all	15
		M8	all	20
2AZ	Toothed-belt pulley to camshaft	M10	M20 / M21 / M40	65
3AZ	Chain sprocket to camshaft flange	M6	M60	15
			all others	10
		M7	M50 / M50 VANOS	1. Application torque 5 2. Joining torque 22
			all others	15
4AZ	Chain sprocket to camshaft		M51	1. Joining torque 20 2. Turn additional 35°
5AZ	Spline to intake camshaft	M14 x 1,5	M50 VANOS	1. Joining torque 40 2. Turn additional 60°

11-19 Engine

				Type	Nm
11 31	Camshaft				
6AZ	Flange to camshaft			M30	145
7AZ	Chain tensioner screw plug	M22x1.5		M50	50
				all others	40
8AZ	Cylinder for chain tensioner plunger	M26x1.5		M50	70
				all others	50
9AZ	Bearing flange to engine block	M6 x 20		M60	13

11-20 Engine

			Type	Nm
11 33	Rocker arms and bearings			
1AZ	Lock screw in rocker arm	M6	M10 / M20 / M30	10
	Lock screw in rocker arm	M6	M21	8

11-21 Engine

			Type	Nm
11 35	Layshaft			
1AZ	Toothed-belt pulley to layshaft	M10	M20 / M21	60

11-22 Engine

			Type	Nm
11 36	Variable valve timing			
1AZ	4/2 directional-control valve to VANOS casing		M50 VANOS	30
2AZ	Banjo bolt to VANOS controller	M14x1.5	M50 VANOS	32
3AZ	Plug screw to VANOS controller	M22x1.5	M50 VANOS	50
4AZ	Plug screw to hydraulic plunger	M36x1	M50 VANOS	60
5AZ	VANOS hydraulic line to oil filter assembly bracket		M50 VANOS	50
6AZ	Collar nut to spline	M6	S50 B30	8
7AZ	Cover to VANOS controller	M5 *	S50 B30	4
8AZ	Filter screw to VANOS controller		S50	12

* Secure bolts with Loctite

11-23 Engine

				Type	Nm
11 41	Oil pump with filter screen and drive				
1AZ	Screw plug for pressure-relief valve			M10 / M30	40
				M20	30
2AZ	Oil pump to engine block	M8	all	22	
3AZ	Oil pump cover	M6	all	10	
4AZ	Chain sprocket to oil pump	M6	M10 / M30	10	
		M10	M60	47	
	Left-hand thread M10x1		M50 / S50	25	
	M10x1		all others	25	

11-24 Engine

		Type	Nm
11 42	Oil filter and lines		
1AZ	Disposable filter (cartridge)	all	hand tight (according to manufacturer's instructions)
2AZ	Full-flow oil filter element (cover)	M8 all	22
		M10 all	33
		M12 all	33
		Cover bolt all	25
3AZ	Oil filter housing (line) to block	M8 all	22
		M20x1.5 M20 B25	40

11-25 Engine

		Type	Nm
11 42	Oil filter and lines		
4AZ	Oil filter drain plug		
	Banjo bolt	M21 / M88-3 / S38	20
	Aluminum bolt	M21	10
	Bolt in threaded insert	M21	23
5AZ	Oil drain line at oil filter and upper pan section (banjo bolt)	M60 / M70 / S70	30
6AZ	Oil lubrication line to bearings and camshafts	M6 all	10
7AZ	Oil line to cylinder head for camshaft lubrication	Banjo bolt M8x1 all	10
		M5 all	5

11-26 Engine

			Type	Nm
11 42	Oil filter and lines			
8AZ	Oil radiator oil lines to oil filter housing	M8	all	22
9AZ	Oil lines to turbocharger	M8	all	22
10AZ	Oil lines from turbocharger to engine block			
	Banjo bolt M16x1.5		all	40
11AZ	Oil line to turbocharger			
	Banjo bolt		all	25
	Union nut		all	30

11-27 Engine

		Type		Nm
11 51	Water pump and drive			
1AZ	Water pump to engine block	M8	all	22
		M6	all	10

11-28 Engine

				Type	Nm
11 52	Fan				
1AZ	Fan clutch to water pump				
	Union nut	Left-hand thread	all		40

11-29 Engine

			Type	Nm
11 53	Thermostat and connections			
1AZ	Thermostat housing	M6	all	10
2AZ	Bleed screw	M8	all	8

11-30 Engine

		Type	Nm
11 61	Intake manifold		
1AZ	Intake manifold to cylinder head	M8 all	22
		M7 all	15
		M6 all	10
2AZ	Sound insulation shield to bracket	M6 M60	8

11-31 Engine

		Type	Nm
11 62	Exhaust manifold		
1AZ	Exhaust manifold to cylinder head*	M6 all	10
		M7 M50	20
		all others	15
	Install upper row of studs with locking fluid	M8 all	22
	Retorque after 2000 km Loosen bolt first	M8 M21	12

* Apply Molykote HSC paste to exhaust nuts and bolts.

11-32 Engine

			Type	Nm
11 62	Exhaust manifold			
2AZ	Exhaust manifold to cylinder head*	M10	M30 / 745i Turbo	
	When mounting on new cylinder head or with new studs			28
	Subsequent mounting			15
	Retorque after 2000 km Loosen bolts first Install studs with Molykote HSC			15
	Protrusion from head:			
	Short studs	88 + 1.0 mm		
	Long studs	98 + 0.5 mm		

* Apply Molykote HSC paste to exhaust nuts and bolts.

11-33 Engine

			Type	Nm
11 65	Intake boost unit with control device			
1AZ	Turbocharge to exhaust manifold	M10	M21	25
			M30 / M51	45
2AZ	Bypass valve to charge tract	M8	M30	25
3AZ	Ring nut to exhaust manifold		M30	220
4AZ	Bolts on recirculation valve	M6	M30	10
5AZ	Charge tract to exhaust manifold	M8	M30	22
6AZ	Oil return flange to turbocharger	M8	M30	22
7AZ	Oil return line to turbocharger	Banjo bolt	M51	10
8AZ	Threaded plug to oil return	M16	M30	45
9AZ	Control line to bypass valve/turbocharger		M30	30

11-34 Engine

		Type	Nm
11 66	Vacuum pump		
1AZ	Vacuum pump to cylinder head	M6 all	10
		M8 M51	22
	microencapsulated M9	M51	22

11-35 Engine

		Type	Nm
11 78	Emissions-control, Lambda oxygen sensor		
1AZ	Lambda sensor	all	55

11-36 Engine

		Type	Nm
11 81	Engine mounts		
1AZ	Rubber bushing to front suspension subframe	M8 all	22
		M10 all	42
2AZ	Rubber bushing to engine support bracket	M8 all	22
		M10 all	42
3AZ	Engine support bracket to engine	M8 all	22
		M10 all	42

12 - 1 ENGINE ELECTRICAL SYSTEM

		Type	Nm
12 11	Distributor		
1AZ	Distributor	M20	22
		M10, M30	10
2AZ	Distributor rotor to adapter with DME	All	2.8
3AZ	High tension distributor cap	All	4

12-2 Engine electrical system

			Type	Nm
12 12	Spark plugs			
1AZ	Spark plugs (unlubricated)	M 12 x 1.25	S 14, M 88-3, S 38, S 50	25
		M 14 x 1.25	M 10, M 20, M 30, M 40, M43 M 50, M 60, M 70, S 70	30
12 13	Ignition coil			
1AZ	Primary connections	KI. 1	all	3.0
		KI. 15	all	4.5

12 - 3 ENGINE ELECTRICAL SYSTEM		Type	Nm
12 14	Electronic Switch or Control Units		
1AZ	TCI control unit	All	2.5
2AZ	Knock sensor	745 IA	13
		All	20
3AZ	Speed and reference mark senders	All with DME	7

12 - 4 ENGINE ELECTRICAL SYSTEM		Type	Nm
12 21	Preheating Relay		
1AZ	Terminal 30 wire to glow plug relay	M51	4
2AZ	80 A fuse for glow plug relay	M51	2
12 23	Glow Plugs		
1AZ	Glow plug	M21	25
2AZ	Glow plug 4"	M21, M51	20
3AZ	Wire to glow plug	M21, M51	4

12-5 Engine electrical system

		Type	Nm
12 31	Alternator with drive and mountings		
1AZ	Wires to alternator		
	Kl. D +	M 10, M 20	5
		all others	7
	Kl. B +	S 38 B38	8
		all others	13
2AZ	Pulley	all	45
3AZ	Pulley (poly-V-belt)	all	55
4AZ	Rear bracket	all	3.5
5AZ	Cylinder bolt for wiring bracket	all	3.5

12 - 6 ENGINE ELECTRICAL SYSTEM		Type	Nm
12 41	Starter and Mounting Parts		
1AZ	Starter	All	50
2AZ	Support to starter	M5 All	5
3AZ	Support to crankcase	All	47
4AZ	Wires to starter		
	Terminal 30h	M5 All	5
	Terminal 50	M6 All	6
	Terminal 30	M8 All	12

12 - 7 ENGINE ELECTRICAL SYSTEM		Type	Nm
12 42	Starter Wiring		
1AZ	Battery positive connection point In power distributor	M8 E32, E34, E31	8
2AZ	Battery positive connection point In power distributor	M8 E36	20
12 52	Plug Connectors, Terminals		
1AZ	Holder for modules	M6 E36	9
2AZ	Ground connections Flange nut	E36	16

12-8 Engine electrical system		Type	Nm
12 61	Oil pressure, oil temperature, oil level display		
1AZ	Oil pressure switch	M 10, M 40, M 42 M 21, M 51, M 20, M 50, M30, M 60, M 70, S 70	40
	Note: Lubricate threads	M 88-3, S 14, S 50, S 38, M 43	20

12 - 9 ENGINE ELECTRICAL SYSTEM

		Type	Nm
12 62	Coolant Temperature		
1AZ	Temperature sensor to water flange (glow time/coolant temperature gage)	M21	18
		M51	13
2AZ	Temperature switch (5.5° C / 17° C) to fuel filter / cylinder head	M21	18
3AZ	Coolant temperature sensor	S38, S50	13
		All others	20
4AZ	Temperature gage sender to cylinder head	All	19
5AZ	Temperature gage sender to coolant flange	S50	13
6AZ	Temperature sensor - air	S50, S38	13
7AZ	Temperature sensor - oil	S50, S38	13

12 - 10 ENGINE ELECTRICAL SYSTEM		Type	Nm
12 63	Switches and Relays		
1AZ	Temperature switch for electronic box	E32, E34, E31	15
12 72	Senders for Control Unit		
1AZ	Lever to pedal value sender	All	9
2AZ	Pedal value sender to pedal console	All	5

12 - 11	ENGINE ELECTRICAL SYSTEM			
		Type	Nm	
	12 90	Control Unit Box		
		Assembly of upper and lower sections	E32, E34, E36	5
		Center section to body	E32, E34	3

13 - 1 FUEL SYSTEM		Type	Nm
13 11	Carburetor		
1AZ	Carburetor to Intake manifold	All	10
2AZ	Carburetor to Insulating flange	All	10
3AZ	Insulating flange to Intake manifold	All	10
3AZ	Idling shutoff valve max.	All	5
4AZ	Flow valve max.	All	28
5AZ	Throttle valve assembly to float housing max.	All	9
6AZ	Throttle valve neck to Intake manifold	All	10
7AZ	Throttle valve control to carburetor max.	2 BE	3
8AZ	Warm-up regulator to engine	All	23

13 - 2 FUEL SYSTEM

		Type	Nm
13 31	Fuel Pump with Drive and Pipes		
1AZ	Fuel pump to engine	All	12
2AZ	Fuel pipe coupling bolt M8	All with K-Jetronic	9
3AZ	Fuel pipe coupling bolt M12	All with K-Jetronic	20
4AZ	Fuel pipe to pressure regulator	All with L-Jetronic	30
5AZ	Return pipe connector to pressure regulator	All with L-Jetronic	27

13 - 3 FUEL SYSTEM		Type	Nm
13 32	Fuel Filter		
1AZ	Fuel pipe to filter housing and Injection pump		
	Coupling nut	M14x1.5	M21, M51
	Adapter	M12x1.5	M21, M51
	Coupling bolt	M14x1.5	M21, M51
2AZ	Fuel filter to holder	M8	M51

13 - 4 FUEL SYSTEM

		Type	Nm
13 51	Injection Pump		
1AZ	Plug for high pressure section of Injection pump	M21, M51	30
2AZ	Distributor Injection pump to holder	M21, M51	22
3AZ	Electric shutoff to Injection pump	M21, M51	20 ± 5
4AZ	Electric cold start valve to Injection pump	M21	20
5AZ	Coupling bolt (OUT) to Injection pump (fuel return)	M21, M51	25
6AZ	Pressure valve holder to Injection pump	M21, M51	45
7AZ	Expansion element housing (temperature dependent Idling speed boost) to Injection pump	M21	18
8AZ	Distributor Injection pump to flange and console	M21, M51	22

13 - 5 FUEL SYSTEM

		Type	Nm
13 52	Injection Pump Drive		
1AZ	Toothed belt pulley to Injection pump	M21	47
2AZ	Chain sprocket to Injection pump	M51	50
3AZ	Chain tensloner	M51	15

13 - 6 FUEL SYSTEM		Type	Nm
13 53	Fuel Injection Nozzles and Pipes		
1AZ	Injection nozzle combination (assembly)	M21, M51	80
2AZ	Injection nozzle combination to cylinder head	M21	40
		M51	65
3AZ	Injection pipe (coupling nut) to injection pump and nozzle combination	M21, M51	20

13 - 7 FUEL SYSTEM

		Type	Nm
13 62	Senders for Control Unit		
1AZ	Temperature time switch	All except diesels	25
2AZ	Coolant temperature sensor	All except diesels and M60	13
		M60	18
3AZ	Temperature switch	All	28
4AZ	Air temperature sensor	All	13

13 - 8 FUEL SYSTEM		Type	Nm
13 64	Fuel Injectors		
1AZ	Fuel Injector to Intake manifold	All	10
2AZ	Coupling nut on fuel Injector	All with K-Jetronic	25

16 - 1 FUEL SUPPLY SYSTEM

		Type	Nm
16 11	Fuel Tank and Mounting Parts		
1AZ	Fuel tank to body		
	Bolt	M8 E30, E31, E32, E34, E36	23
	Nut	M8 E30	25
		E24	45
	Retaining strap		8
2AZ	Connecting pipe to fuel tank	E30	25
3AZ	Heat shield to fuel tank	E30	8.5
		E24	10
		E31	3
4AZ	Drain plug on fuel tank	All	25

16 - 2 FUEL SUPPLY SYSTEM

		Type	Nm
16 12	Fuel Supply		
1AZ	Pump assembly to metal-bonded mount	All with fuel Injection	6.5
2AZ	Holder to fuel pump or fuel reservoir	All with fuel Injection	6.5
3AZ	Electric connections on fuel pump	All with fuel Injection	2
4AZ	Electric connections on fuel pump M4	All with fuel Injection	1.2
5AZ	Electric connections on fuel pump M5	All with fuel Injection	1.6
6AZ	Plastic nut on cover for fuel pipes	E30	2
7AZ	Hose clamps 10 ... 16 mm dia.	All	2

<div>16 - 3</div> <div>FUEL SUPPLY SYSTEM</div>	Type	Nm
<div>16 13</div> <div>Fuel Vapor Venting</div>		
<div>1AZ</div> <div>Fuel vapor venting tank to body</div>	E24	3
	E30	4.5

16 - 4 FUEL SUPPLY SYSTEM

		Type	Nm
16 14	Fuel Pump		
1AZ	Fuel level sender to fuel Intake	All with transfer pump in tank	2
		E32	8
2AZ	End ring for fuel tank (fuel level sender/pump)		
	26.5 mm high	E34, E31	40
	31.5 mm high (new)	E36, E34, E31	55

17 - 1 COOLING SYSTEM		Type	Nm
17 00	Coolant		
1AZ	Coolant hoses 32 ... 48 mm dia.	All	2.5
2AZ	Bleeder screw (8 mm wrench size) on thermostat housing	All	8
3AZ	Level switch (30 mm wrench size) to coolant expansion tank	All	3

17 - 2 COOLING SYSTEM		Type		Nm
17 11	Radiator and Mounting Parts			
1AZ	Radiator to body			
	Self-tapping screw	B6.3	All	9
	Screw	M6	All	10
2AZ	Drain plug on radiator	All		2.5
3AZ	Temperature switch to radiator (91° / 99° C)	max.	All	15
4AZ	Expansion tank to body	All		9

17 - 3 COOLING SYSTEM		Type	Nm
17 21	Engine Oil Cooler		
1AZ	Engine oil cooler to body	All	14
	Oil cooler vapor extraction guide to trim panel	B4.8 M3 E36	4

17 - 4 COOLING SYSTEM		Type	Nm
17 22	Oil Cooler Pipes		
1AZ	Pipes to engine oil cooler	All	28
2AZ	Pipes to oil filter head	M3 E36	25
3AZ	Holder to oil cooler pipes	All	6
4AZ	Oil cooler pipe holder to alternator	M6 M3 E36	10

17 - 5 COOLING SYSTEM

		Type	Nm
17 22	Oil Cooler Pipes		
5AZ	Coupling nuts on transmission oil cooler (on radiator) and on transmission		
	M18x1.5	All	20
	M22x1.5	5 HP 30	28
6AZ	Oil pipes to transmission		
	Coupling bolt M16x1.5	All	37
7AZ	Oil pipes to transmission oil cooler		
		A 5 S 300 J	28
	Coupling bolt M14x1.5	All	27
8AZ	Adapters to transmission		
	M14x1.5 and M16x1.5	All	37
9AZ	Oil hose to oil pipe	745I A	28
10AZ	Oil pipe holder to cooler	745I A	2
11AZ	Oil pipe holder to body	745I A	6.5
12AZ	Oil cooler to transmission	5 HP 30	10

18-1 Exhaust system

		Type	Nm
18 00	Exhaust system, complete		
1AZ	Exhaust pipe to exhaust manifold or turbocharger		
	Spring-loaded version Tighten down nuts evenly until spring is against block then loosen 1.5 turns	M30 / M70	10
	Tighten nuts until spring is tensioned to 27 ± 1 mm	M51	-
2AZ	Exhaust pipe to flow conductor	745I A	25
3AZ	Resonator clamp	M8 all	15

Listings are for non-standard torques.
For standard torques consult Torque Specifications.

21- 1 Clutch

		Type	Nm
21 11	Bellhousing		
1AZ	Bellhousing to engine block	M 8 all	27
		M 10 all	51
		M 12 all	86

21- 2 Clutch

			Type	Nm
21 21	Clutch and clutch disk			
1AZ	Clutch to flywheel			
	6-point bolt 8.8	M8	all	24
	Cylinder bolt 8.8	M8	all	24
	6-point bolt	10.9 M8	S38 B36 * / S14 *	34
	Cylinder bolt	10.9 M8	all	34

* Replace bolt and taper sleeve.

21- 3 Clutch

		Type	Nm
21 52	Clutch release mechanism (hydraulic)		
1AZ	Union nuts for hydraulic lines	all	16
2AZ	Master cylinder to mounting bracket	all	22
3AZ	Master cylinder dowel screw	all	22
4AZ	Master cylinder to pedal assembly	all	10
5AZ	Slave cylinder to bellhousing/ transmission casing	all	22

23 - 1 MANUAL TRANSMISSION

23 00 Transmission Assembly

1AZ Transmission to engine

Hexagon head bolts

M8

All

25

M10

All

49

M12

All

74

Torx bolts

M8

All

22

M10

All

43

M12

All

72

23 - 2 MANUAL TRANSMISSION

			Type	Nm
23 00	Transmission Assembly			
2AZ	Transmission to clutch housing	M12	All	76
3AZ	Reinforcement plate to transmis- sion	M8	All	23
4AZ	Oil drain plug / filler plug		All	50
			S 6 S 560 G	52

23 - 3 MANUAL TRANSMISSION

		Type	Nm
23 11	Case and Covers		
1AZ	Transmission case rear/front sections	All	22
2AZ	Cover with guide tube/transmission case		
	M8x22	All	18
	M8x30	All	25
	M6	All	10
3AZ	Bearing cap/sealing flange	All	10.5
4AZ	Reverse gear shaft to transfer case	All	49
5AZ	Reverse gear shaft holder to transfer case	All	25

23 - 4 MANUAL TRANSMISSION

			Type	Nm
23 11	Case and Covers			
6AZ	Reverse gear shaft to case	M8	All	25
			S 5 D 310 Z	20
		M10	All	45
7AZ	Support for reverse gear shaft	M8	240 / 260	25
8AZ	Mount bracket to rear case section	M6	240 / 260 / 265 / 280	10
9AZ	Mounting tabs for sealing cover	M6	280	10
10AZ	Mount to layshaft			
	(Installed with bolt cement)	M10	S 5 D 200 G	1. 70 Initial torque 2. Loosen 3. 60 final torque
			S 5 D 310 Z	30
			280	60

23 - 5 MANUAL TRANSMISSION

		Type	Nm
23 11	Case and Covers		
11AZ Plug on rear case section	M20	All	60
	M16	240	40
	M22	260 / 280	60
12AZ Sealing caps on rear case section	M6	240 / 260 / 280	10
13AZ Reversing bolt to reversing lever		ZF S 5/16/S 5 D 310 Z	43
14AZ Clamping claws to rear case section		ZF S-5/16/S 5 D 310 Z	33
15AZ Locking plate screws		ZF S-5/16/S 5 D 310 Z	9

23 - 6 MANUAL TRANSMISSION

		Type	Nm
23 11	Case and Covers		
16AZ	Holder to transfer case	M6 265/Sport	9
17AZ	Holder to rear case section	S 5 D 310 Z / S 5 D 200 G / 250 G	10

23 - 7 MANUAL TRANSMISSION

		Type	Nm
23 21	Transmission Shafts		
1AZ	Output flange Collar nut installed with bolt cement	All	1. 170 initial torque 2. Loosen 3. 120 final torque
2AZ	Gear wheel to layshaft	M10 265/Sport	60

23 - 8 MANUAL TRANSMISSION

		Type	Nm
23 31	Interior Shift Components		
1AZ	Shift arms to transmission case	S 5 D 310 Z	45

23 - 9 MANUAL TRANSMISSION

		Type	Nm
23 71	Transmission Suspension		
1AZ	Transmission mounts (rubber) to cross member	M10 All	42
2AZ	Transmission cross member to body	M10 All	42
		M8 All	21
3AZ	Mount bracket to transmission	M8 All	21

24 - 1 AUTOMATIC TRANSMISSION		Type		Nm
24 00	Transmission Assembly			
1AZ	Transmission to engine			
	Hexagon head bolts	M8	All	24
	Hexagon head bolts	M10	All	45
	Hexagon head bolts	M12	All	82
	Torx bolts	M8	All	21
	Torx bolts	M10	All	42
	Torx bolts	M12	All	63
2AZ	Reinforcement plate to transmission	M8	All	23

24 - 2 AUTOMATIC TRANSMISSION

			Type	Nm
24 11	Transmisslon Case, Oil Sump			
1AZ	Transmisslon extension	M8	All	25
			A 4 S 310 R	32
2AZ	Guard	M6	All	9
3AZ	Converter bell housing	M8	All	25
		M10	4 HP-22/24	46
			A 4 S 310 R	42
4AZ	Plug on transfer plate	M10	All	16
		M14	4 HP-22/24	40
		M20	4 HP-22/24	50

24 - 3 AUTOMATIC TRANSMISSION

			Type	Nm
24 11	Transmission Case, Oil Sump			
5AZ	Oil sump	M6	All	9
			4 HP-22/24 / A 5 S 310 Z	7
			A 5 S 300 J	9
			A 4 S 310 R	12
			A 5 S 560 Z	10
6AZ	Oil drain plug	M10	All	16
			A 4 S 310 R	25
			A 5 S 300 J	35
			A 5 S 560 Z	50
7AZ	Oil filler plug		A 4 S 310 R	33
			A 5 S 300 J	40
			A 5 S 310 Z / A 5 S 560 Z	100

24 - 4 AUTOMATIC TRANSMISSION

24 - 4 AUTOMATIC TRANSMISSION		Type	Nm
24 11	Transmission Case, Oil Sump		
8AZ	Oil filler pump	3 HP-22	105
		4 HP-22/24 / A 5 S 310 Z	98
9AZ	Plug	M18 All	43
10AZ	Oil bore plugs	A 5 S 300 J	8
		A 5 S 310 Z / A 5 S 560 Z	15

24 - 5 AUTOMATIC TRANSMISSION		Type	Nm
24 13	Transmission Extension, Bearings, Seals		
1AZ	Slotted nut / output flange	A 5 S 310 Z / A 5 S 560 Z	120

24 - 6 AUTOMATIC TRANSMISSION		Type	Nm
24 21	Input, Intermediate and Output Shafts		
1AZ	Output flange collar nut	A 5 S 300 J	225
		All	100

24-7 Automatic transmission

		Type	Nm
24 22	Planetary gear set		
1AZ	Brake coupling D/G to transmission casing	M 8 A5S 310Z	<ol style="list-style-type: none">1. Screw in all bolts until firm contact is made.2. Center bolt 303. Two outside bolts 15, then 304. Starting at center, all bolts to 63

24-8 Automatic transmission			Type	Nm
24 23	Shift clutches			
1AZ	Torx bolts for clutch F to transmission casing	M 6	4 HP-22/24	10

24-9 Automatic transmission

			Type	Nm
24 30	Hydr./elec. control elements			
1AZ	Shift body to transmission	M 6	3 HP-22	11
		M 6	4 HP-22/24/A5S 310Z	8
			A4S 310R	20
		M6 x 12	A5S 560Z	6
		M6 x 55		8
2AZ	Valve body to shift body	M 6	all	5

24-10 Automatic transmission

			Type	Nm
24 31	Fluid pump			
1AZ	Fluid pump to casing	M 6	all	11
			A4S 310R	20
2AZ	Fluid filter screen		all	8
			A5S 310Z / A5S 560Z	6
3AZ	Fluid pump housing		A4S 310R	20
			A5S 310Z	10
4AZ	Tube fittings, fluid radiator lines to transmission		A5S 300J / A4S 310R	28

24-11 Automatic transmission

			Type	Nm
24 32	Governor			
1AZ	Governor flange to transmission	M 8	all	16
2AZ	Threaded stud to centrifugal governor	M 6	all	3
3AZ	6-point nut to threaded stud		all	10
4AZ	6-point bolt to centrifugal governor	M 6	all	11
5AZ	Governor housing to hub	M 6	4 HP 22/H	11

24-12 Automatic transmission

			Type	Nm
24 34	Shift valves, parking lock			
1AZ	Pressure regulator to valve body	M 6	4 HP-22/24 EH/A5S 310Z	5
			A4S 310R	10
2AZ	Solenoid valve to valve body	M 6	4 HP-22/24 EH/A5S 310Z	5
			A4S 310R	10
			A5S 560Z	6
3AZ	Guide plate for parking lock mechanism		A5S 310Z	10
			A5S 560Z	23
4AZ	Pulse generator	M5	A5S 310Z	5
			A5S 300J	6
			A5S 560Z	6
		M8		23

24-13 Automatic transmission				Type	Nm
24 35	Wiring harness, shift elements and gauge				
1AZ	Transmission socket to casing	M 26		4 HP-22/24 EH/A5S 310Z	12
				A4S 310R	14

24-14 Automatic transmission

24-14 Automatic transmission		Type	Nm
24 40	Torque converter		
1AZ	Torque converter to flywheel	M 8 all	26
		M 10 all	49
		A4S 310R/A5S 310Z/ A5S 300J / A5S 560Z	45

24-15 Automatic transmission

24-15 Automatic transmission				Type	Nm	
24 51	External shift linkage					
1AZ	Selector lever to transmission			M 8	all	9
				A4S 310R	20	
				A5S 300J	15	

24-16 Automatic transmission

		Type	Nm
24 52	Internal shift mechanism		
1AZ	Shift segment to shaft	A4S 310R	22

24-17 Automatic transmission

		Type	Nm
24 71	Transmission mounts		
1AZ	Cross member to floorpan	all	21
2AZ	Rubber bushings to cross member/ transmission	all	21
3AZ	Support tube to engine subframe	E36	42
4AZ	Rubber bushing to support tube	E36	21
5AZ	Support plate	E36	21

25 - 1 GEAR SHIFT MECHANISM

		Type	Nm
25 11	Shift Console - Manual Transmisslon		
1AZ	Front console to shift console	All with sheet metal console	25
2AZ	Shift console to transmisslon	All with sheet metal console	23
3AZ	Rear shift console to body	All	11
4AZ	Aluminum shift arm console to transmission	E30 M 3	21.5
5AZ	Aluminum shift arm to console	E30 M 3	11
6AZ	Shift arm console to body	All	21
		E31	9
7AZ	Adjustable shift rod (clamp)	E31	23

25 - 2 GEAR SHIFT MECHANISM

		Type	Nm
25 16	Shift Console - Automatic Transmission		
1AZ	Cable sleeve to holder - shift console and transmlssion	All	10
2AZ	Clamping screw on transmlssion	All	11
3AZ	Shift console to tunnel	All	7
4AZ	Switch to shift console	All	4.5

26-1 Driveshaft

		Type	Nm
26 11	Driveshaft assembly		
1AZ	Front coupling to driveshaft and transmission	M10/8.8 all	48
		M10/10.9 all	64
		M14 E 31	160
		M12/8.8 E 32, E 34, E 36	81
		M12/10.9 E 32, E 34, E 36	100
			115
2AZ	Driveshaft U-joint to transmission	M 10 all	64
		M 12 E 32, E 31	95
3AZ	Thrust piece clamp ring after installation in vehicle	all	10
		E 30 4WD	22

26 - 2 PROPELLER SHAFT

		Type		Nm
26 11	Propeller Shaft Assembly			
4AZ	Propeller shaft to drive flange (rear axle)			
	Universal joint			
	Squeeze nut *	M10	All	64
	Ribbed nut	M10	All	90
	Constant velocity joint			
	Squeeze nut *	M8	All	32
	Ribbed nut	M8	All	43
		M10	All	64
5AZ	Pivot to center propeller shaft journal with Loctite (version without slide)		All	97
6AZ	Center mount to body		All	21

* After loosening connection only use ribbed nuts with higher tightening torque.

27 - 1 TRANSFER BOX - Four Wheel Drive -				Type	Nm
27 00	Transfer Box In General				
1AZ	Transfer box to manual transmission	M10	All		42
2AZ	Transfer box to automatic transmission	M8	All		23
3AZ	Coupling to manual transmission and transfer box	M12	All		90
4AZ	Case bolts	M8	All		25
5AZ	Electromagnetic clutch to case	M8	All		25
6AZ	Output flange Collar nut installed with Loctite 270 or Hylogrip bolt cement		All		110

27 - 2 TRANSFER BOX - Four Wheel Drive -		Type		Nm
27 00	Transfer Box In General			
7AZ	Plug	M24x1.5 M14x1.5	All	33
		M18x1.5	All	23
8AZ	Transmission cross member to rubber mounts	M12	All	80
	Transmission cross member to body	M8	All	24

31 - 1 FRONT AXLE

		Type	Nm
31 00	General Information		
	For screwed connections, which can influence handling, it is also important to have the "car loaded down to normal position" in addition to the tightening torque.		
	Car in normal position:		
	Car with complete equipment for normal operation loaded down with 2 x 68 kg on front seats (seats in center position), 1 x 68 kg on rear seat (center), 1 x 21 kg in trunk (middle) and full fuel tank.	All models except those listed below	
	Car with complete equipment for normal operation loaded down with 2 x 68 kg on front seats (seats in center position), 1 x 14 kg in trunk (middle) and full fuel tank.	E24, E31, M3, M5, Convertibles	

31 - 2 FRONT AXLE		Type	Nm
31 10	Front Axle Suspension		
1AZ	Front axle carrier to engine carrier	M10 9.8 All	47
		M10 8.8 All	42 (325IX with Loctite)
		M12 All	77
		M12 12.9 E36 *	105
2AZ	Front end of front axle carrier to body	M10 8.8 E34 525IX	47
3AZ	Rear end of front axle carrier to body (shoulder bolt)	E34 525IX	59
4AZ	Front axle carrier with reinforcement to engine carrier	E31	47
5AZ	Reinforcement to side member	E31	42
6AZ	Reinforcement to bracket and bracket to body	E31	42
7AZ	Reinforcement (sleeve) to body	E31	127

- * Always replace and lubricate bolts with LM 48 paste.

31 - 3 FRONT AXLE

		Type	Nm
31 12	Control Arms and Struts		
1AZ	Leading strut to front axle carrier (tightened with car in normal position - see page 31 - 1)	E12, E24 until 5.82	80
		E23	135
2AZ	Control arm to front axle carrier (tightened with car in normal position - see page 31 - 1 - not E31)	E21, E12, E24 until 5.82, E32, E34, E31	77.5
3AZ	Control arm (ball joint) to front axle carrier	E30, E36	85
		E30 325iX	100
4AZ	Control arm to spring strut	E21, E30	65
5AZ	Control arm to pivot mount/spring strut	E30 325iX	85 93 (polystop nut)
		E34 525iX	80

31 - 4 FRONT AXLE

	Type	Nm
31 12 Control Arms and Struts		
6AZ Control arm to steering knuckle	E36	62
7AZ Control arm bracket to engine carrier	E30	42
	E36	47
8AZ Ball joint for control arm to front axle carrier	E34 525IX	77
9AZ Control arm to ball joint	E34 525IX	80
10AZ Control arm bracket to front axle carrier	E34 525IX	47
11AZ Trailing strut to body (tightened with car in normal position - see page 31 - 1)	E28, E24 after 5.82	130
12AZ Trailing strut to tie rod arm	E28, E24 after 5.82, E32, E34, E31	93

31 - 6 FRONT AXLE		Type	Nm
31 21	Wheel Bearings and Steering Knuckle		
1AZ	Collar nut (bearing unit)	E28, E24 after 5.82, E30, E32, E34, E31, E36	290
2AZ	Output shaft to drive flange	E30 325iX, E34 525iX	250
3AZ	Castle nut (refer to Repair Manual for tightening Instructions)	E21, E12, E24 until 5.82, E23	
4AZ	Steering knuckle to spring strut	M12x20 E36	107 *
	Fit bolt	M12x42 E36	107

* Bolts are micro-encapsulated - always replace.

31 - 7 FRONT AXLE		Type	Nm
31 31	Spring Struts		
1AZ	Spring strut mount to wheel house	All	22
2AZ	Shock absorber piston rod to mount	E21, E23, E12, E24 until 5.82	80
	M14	All	64
	(with external hexagon piston rod) M12	All	64
	(with Internal hexagon piston rod) M12	All	44
3AZ	Spring strut shock absorber to pivot mount	E34 525IX	80

31 - 8 FRONT AXLE

		Type	Nm
31 32	Shock Absorbers		
1AZ	Screw-on ring for spring strut shock absorber	All	130

31 - 9 FRONT AXLE

		Type	Nm
31 35	Stabilizer		
1AZ	Holder to front axle carrier or body	E21	50
		E12, E24 until 5.82	45
		M8 All	22
2AZ	Stabilizer to control arm (tightened with car in normal position - see page 31 - 1)	E21	130
3AZ	Stabilizer link to control arm and stabilizer (tightened with car in normal position - see page 31 - 1)	M8 E23	25
		M10 E23	50
4AZ	Stabilizer link to control arm	E34 525IX	22
5AZ	Stabilizer link to stabilizer	E34 525IX	78

31 - 10 FRONT AXLE		Type	Nm
31 35	Stabilizer		
6AZ	Push rod to spring strut and stabilizer (yellow chrome-plated)	E28	20
	(white chrome-plated)	E28, E24 after 5.82	33
	(yellow)	E32, E24 after 5.82, E28, E34, E31	59 *
7AZ	Push rod to spring strut and stabilizer	M3, E36	59 *
		325IX	47
8AZ	Push rod (with pivot) to stabilizer	E30	47
9AZ	Pivot to control arm	E30, E36	42

* Flat surfaces on ball head for application of wrench must be parallel to absorber axis.

31 - 11 FRONT AXLE

		Type	Nm
31 50	Front Axle Final Drive		
1AZ	Front axle final drive to engine oil pan	E30, E34	42
2AZ	Filler plug	E30	53
		E34	70
3AZ	Drain plug	E30	20
		E34	70
4AZ	Pinion/ring gear to front axle final drive	E30	22
5AZ	Bearing cap to front axle final drive	E30	22
6AZ	Front axle final drive case bolts	E34	74 ± 4

31 - 12 FRONT AXLE		Type	Nm
31 52	Ring Gear / Pinion with Bearings		
1AZ	Pinion collar nut	E34	at least 170
2AZ	Ring gear bolt *	E30	1. 50 + 5 Nm torque 2. 60 - 5° torque angle

- * Always replace bolts. Clean tapped bores in ring gear. Use bolt cement (source of supply: BMW Parts).

31 - 13 FRONT AXLE

		Type	Nm
31 60	Output Shaft		
1AZ	Output shaft console to engine oil pan	E30, E34	22

32-1 Steering and front-end alignment

		Type	Nm
32 00	Steering		
1AZ	Steering gear to front axle subframe	E 21	50
		E 21 (Hydro)	41
		E 12, E 24 up to 5.82, E 23	42 ± 4
	M 10	E 28, E 24 from 5.82, E 30, E 32*, E 34*, E 31*, E 36	42
	M 12	E 28, E 24 from 5.82, E 32, E 34, E31	80 ± 8
	M12 10.9	E 32/3	110 ± 13

* Class 10.9 bolts must be used for assembly

32 - 3 STEERING AND WHEEL ALIGNMENT

		Type	Nm
32 13	Power Steering Gear		
1AZ	End cover for worm	E12, E24 until 5.82	34
2AZ	End cover for sector shaft	E12, E24 until 5.82	31
3AZ	Lock nut of adjusting screw for piston motion	E12, E24 until 5.82	6
4AZ	Lock nut of adjusting screw	All	27
5AZ	Oil drain plug	All	42

32 - 4 STEERING AND WHEEL ALIGNMENT

		Type	Nm
32 13	Power Steering Gear		
6AZ	Ring nut (with 2.5 mm dia. wire)	E30	120
	(with 2.5 mm dia. wire)	E30	150
7AZ	Valve housing to case	E30	18
8AZ	Pressure piece cover	E30	18
9AZ	Pipes (coupling bolts) to steering gear		
	M10	E30	10
	M12	E30	20
10AZ	Coupling bolt with hexagon socket	525iX	20
11AZ	Pipe (pipe cringe) to steering gear	E30, E36	8

32 - 5 STEERING AND WHEEL ALIGNMENT

		Type	Nm
32 21	Steering Arms		
1AZ	Tie rod to ball joint (castle nut)	E21	60
2AZ	Tie rod to rack	E21, E30	75
		E36	71
3AZ	Tie rod castle nut/self-locking nut <i>Important!</i> Tie rods with cotter pin holes may not be bolted on with self-locking nuts.	All except E34 525IX	36.5 ± 3.5 50
4AZ	Tie rod clamping bolt (tightened with car in normal position - see page 31 - 1)	All	14
5AZ	Tie rod castle nut	E36, E34 525IX	45

32 - 6 STEERING AND WHEEL ALIGNMENT		Type	Nm
32 21	Steering Arms		
6AZ	Steering drop arm to steering gear (torque value may be exceeded until position to lockplate is correct)	M22 All	at least 140
		M26 E23	at least 180
		E32, E34	59
		E31	70
7AZ	Steering guide arm to front axle carrier	M10 All	42
		M12 All	85

32 - 7 STEERING AND WHEEL ALIGNMENT

		Type	Nm
32 21	Steering Arms		
8AZ	Tie rod arm to spring strut		
	wire lock	E12, E24 until 5.82	55
	Loctite No. 270	E28, E24 after 5.82, E23	62 *
		E32, E34, E31	110 *
		M3	30 *
9AZ	Tie rod arm to control arm	E12, E24 until 5.82, E23, M3	66
		E28, E24 after 5.82, E32, E34, E31	93
10AZ	Leading strut to tie rod arm	E23	93
11AZ	Trailing strut to tie rod arm	E32, E34, E31	93

- Clean threads of tapped bores and bolts.

32 - 8 STEERING AND WHEEL ALIGNMENT

		Type	Nm
32 31	Steering Column		
1AZ	Universal joint / coupling to steering gear / steering spindle	E12, E24 until 5.82	25
		E21, E30, E28, E23, E24 after 5.82, E32, E34, E31	22
		E36	19
2AZ	Steering wheel control console to dashboard carrier and pedal assembly console	M8 All	22
3AZ	Hexagon head bolt on steering wheel control console	M10x115 E12, E24 until 5.82	25
		M8x110 E28, E24 after 5.82	22
		M10x170 E23	27

Refer to Repair Manual for
E32, E34 and E31 models.

32 - 9 STEERING AND WHEEL ALIGNMENT		Type	Nm
32 31	Steering Column		
4AZ	Clamp / shackle for outer steering tube	All	22
		E23	10
5AZ	Airbag: Steering column to holder	All	18
6AZ	Steering column to dashboard	All	22
7AZ	Steering column to arm	All	14

32 - 10 STEERING AND WHEEL ALIGNMENT		Type	Nm
32 33	Steering Wheel		
1AZ	Steering wheel to steering spindle	nut	80
		bolt	63

32 - 11 STEERING AND WHEEL ALIGNMENT

		Type	Nm
32 34	Airbag and Airbag Steering Wheel		
1AZ	Airbag unit to steering wheel	All	8
2AZ	Crash sensor to wheel house	All	10

32 - 12 STEERING AND WHEEL ALIGNMENT

		Type	Nm
32 41	Pump and Oil Supply		
1AZ	Power steering pump console to crankcase (use spacers) - refer to Service Information of Group 32	All	22
2AZ	Pump support to engine carrier	E32 M60	22
3AZ	Hose connections on power steering pump and steering gear	M14 All	35
		M16 All	40
4AZ	Hose connections on power flow regulator	All	40

33-1 Final drive and rear suspension

33-1 Final drive and rear suspension			Type	Nm
33 11	Differential housing with cover			
1AZ	Housing cover	M 10/8.8	all	45
		M 10/10.9	E 31	90
2AZ	Side covers (In continuous sockets, coat bolts with Loctite 270)	M 8	all except E 36	22
		M 8*	E 36	1. Initial torque 10 +2 2. Turn additional 40° +5°
3AZ	Filler and drain plugs		all	70
4AZ	Drive flange, right side	M 10	E 34 4WD	59
5AZ	Drive flange, left side	M 14x1.5*	E 34 4WD	1. Initial torque 90 2. Turn additional 100° +4°

* Always replace bolts

33-3 Final drive and rear suspension

				Type	Nm
33 12	Ring and pinion assembly with bearings				
1AZ	Ring gear to differential housing	M 10*	all		1. Intial torque 50 +5 2. Turn additional 60° -5°
		M 12x1.5*	all		1. Intial torque 100 +10 2. Turn additional 50° +5°
		M 14x1.5*	all		1. Intial torque 100 +10 2. Turn additional 30° +4°

* Always use new bolts for assembly. Bolts clean with no oil or grease; secure with Loctite 270.

33-4 Final drive and rear suspension

				Type	Nm
33 12	Ring and pinion assembly with bearings				
2AZ	Drive flange to crown wheel		M 20	K	min. 175
			M 20	M	min. 185
			M 22	G	min. 210

Type K = Side cover with 4 bolts
Type M = Side cover with 6 bolts
Type G = Side cover with 8 bolts

33-5 Final drive and rear suspension

			Type	Nm
33 14	Limited-slip differential with bearings			
1AZ	Cover to differential housing	M 8*	all	33
		M 10*	all	47

* Secure bolts with Loctite 270

33-6 Final drive and rear suspension

		Type	Nm
33 17	Differential mountings		
1AZ	Differential to subframe	E 21	90
		E 12, E 24 up to 5.82	80
		E 28 and E 24/5.82, E 30 E 32, E 34, E23	123
	front	E 36	95
	rear	E 36, E 31	77
2AZ	Differential to swing mounting, swing mounting to floorpan	E 30, E 21	90
3AZ	Differential to rubber bushing	E 12, E 28, E 24, E 23	87
		E 34, E 32	77
4AZ	Differential cover rubber bushing to floorpan	E 30	87
5AZ	Differential carrier to housing cover	E 32	81
	M 12/10.9	E 32, E 34	102

33-9 Final drive and rear suspension

		Type	Nm
33 21	Axle shafts		
1AZ	Axle shaft to differential and drive flange		
	Cylinder bolt	M 10 all	83
		M 10 with locking teeth*	96
		M 12 all	110
	Torx bolt	M 10 all	83
		M 8 with ribbed teeth*	64
		M 10 with ribbed teeth*	100
2AZ	Drive flange to axle shaft	E 30	200
	(collar nut lightly lubricated)	E 36 except M3	250
		E 31, E36 M3	300

* Replace bolts and washers

33-10 Final drive and rear suspension

			Type	Nm
33 32	Rear suspension			
1AZ	Trailing arm to rear subframe (Tighten in normal position, see p. 31-1)		all	67
		10.9	all	77
			M 5-E 34	79 ± 8*
2AZ	Trailing arm to floorpan	M 14x1.5	E 31	127
3AZ		M 18x1.5	E 31	278
4AZ	Trailing arm to wheel carrier (taper pin and socket must be grease-free!)		E 31	80
5AZ	Control arm to rear subframe		E 31	95
6AZ	Support arm to rear subframe	M 14x1.5	E 31	127
7AZ	Control arm to wheel carrier		E 31	150
8AZ	Upper control arm to wheel carrier	M 14x1.5	E 31	127

* With special tool 33 3 060
Set torque wrench to 55 Nm

33-12 Final drive and rear suspension

33-12 Final drive and rear suspension			Type	Nm
33 32	Rear suspension			
16AZ	Angle brace to body		E 21, E 30	28
17AZ	Radius rod to floorpan	M 8/8.8	all	25
		M 8/10.9	E 30	30
18AZ	Secondary control arm to trailing arm and rear subframe (Tighten in normal position, see p. 31-1)	M 14x1.5	all	127
19AZ	Brace to rear subframe	M 12x1.5	E 32, E 34	110

33-13 Final drive and rear suspension

		Type	Nm
33 33	Rear subframe		
1AZ	Rubber bushings to rear subframe	E 21, E 23	95
		E 21, E 28, E 24	40
2AZ	Threaded studs to floorpan	E 36	120
3AZ	Rear subframe with rubber bushings to floorpan	M 12x1.5 E 36	77
		M 14x1.5 all	140
4AZ	Rear rubber bushing to floorpan	M 10* E 32, E34	45
5AZ	Rear subframe to rear rubber bushings	M 12 E 32, E34	77

* Bolts and threads free of oil and grease;
secure with Loctite 270

33-17 Final drive and rear suspension

		Type	Nm
33 52	Shock absorbers		
1AZ	Shock absorber to trailing arm, support arm/control arm (Tighten in normal position, see p.31-1)	E 12, E 24, E 23, E 28 E 32, E 34	127
		E 21	54
		E 30	87
		E 36	100
		E 31	115
	10.9 bolt	E 30, E 34, E 32	130
2AZ	Strut shock absorber to spring dome	E 21, E 30	15
3AZ	Nut and locknut/self-locking nut	E 28, E 34, E 24, E 23	25
4AZ	Shock absorber to rubber bushing	E 30	15
5AZ	Shock absorber with rubber bushing to body	M 8 all	22

33-18 Final drive and rear suspension

			Type	Nm
33 55	Anti-roll bar			
1AZ	Anti-roll bar to trailing arm (Tighten in normal position, see p.31-1)	M 8	E 30, E 31	22
		M 10	E 31	42

34 - 1 BRAKES		Type	Nm
34 00	Testing and Bleeding Brakes		
1AZ	Bleeder valve wrench size 7 mm	All	5
	wrench size 9 mm	All	6
34 11	Front Wheel Brakes		
1AZ	Brake disc to wheel hub	All	16
2AZ	Brake callper to steering knuckle (bolts oiled lightly)	E30 325IX, E36, E34, E32, E31	110
		E21, E12, E24, E23	95
		E28, E24 after 5.82, E30	123
3AZ	Guide bolt wrench size 7 mm	E28, E34, E24 after 5.82, E30, E32, E31, E36	30 - 5
4AZ	Bolts to guldepin (always replace)	E30	35

34 - 2 BRAKES

		Type	Nm
34 21	Rear Wheel Brakes		
1AZ	Brake drum/disc to wheel hub	All	16
2AZ	Wheel cylinder to brake backplate	All	10
3AZ	Brake backplate to trailing arm	All	65
4AZ	Brake callper to trailing arm / brake backplate	All	67
5AZ	Guide bolt wrench size 7 mm	All	30 - 5

34-3 Brakes				Type	Nm
34 31	Master cylinder				
1AZ	Master cylinder to vacuum booster			E 30	24
				E 32	21
				E 28, E 34, E 36	26
2AZ	Master cylinder to hydraulic booster			E 24, E 28, E 31*, E 32*, E 34*	28
34 32	Brake lines				
1AZ	Brake hose couplings	M 10 x 1	all		19
		M 12 x 1	all		17

* Replace Allen bolt with a 6-point bolt,
see BMW Parts Service

34 - 5 BRAKES	Type	Nm
34 33 Brake Booster		
10AZ Hydraulic pipe to pressure reservoir on power flow regulator	E32, E31	47
11AZ Hydraulic pipe to pressure reservoir	E32, E31	40
12AZ Brake booster to pedal assembly console	All	22
34 50 Antislip Control Systems (ABS, ASC) ASC + T filter bowl to filter head	E31, E32, E34	15

35 - 1 PEDALS		Type	Nm
35 11	Pedal Assembly Console		
1AZ	Console to body	All	22
2AZ	Nut on shaft	All	27

35 - 2 PEDALS

		Type	Nm
35 21	Brake Pedal and Linkage		
1AZ	Piston rod lock nut	All	27
2AZ	Nut on shaft	All	27
3AZ	Pull rod Nut for pivot	All	27
4AZ	Left and right reversing lever Nut on shaft bolt	All	27
5AZ	Support to console Brake booster	All	22
6AZ	Support to console Reversing lever	All	27

35 - 3 PEDALS

		Type	Nm
35 31	Clutch Pedal and Linkage		
1AZ	Piston rod lock nut		
2AZ	Spring lock nut	All	6
3AZ	Piston rod shaft bolt	All	22
4AZ	Master cylinder to pedal assembly console	All	9
5AZ	Spring-pedal shaft bolt	All	22
6AZ	Clutch pedal Nut on eccentric bolt	All	22

35 - 4 PEDALS			
		Type	Nm
35 41	Accelerator Pedal and Linkage		
1AZ	Full throttle stop	All	10

36 - 1 WHEEL RIMS AND TIRES

Type

Nm

36 10 Wheels

1AZ Wheel bolts

All

100 ± 10

36 - 2	WHEEL RIMS AND TIRES		
		Type	Nm
36 11	Wheel Rims		
1AZ	Blade rim to base rim (bolts coated with blue Loctite No. 243)	All	9

37 - 1 INTEGRATED SUSPENSION SYSTEMS

		Type	Nm
37 12	Ride Level Control System		
1AZ	Pressure pipe connections (electrical system)	All	14
2AZ	Pressure pipe connections (circulating system)	E32, E34	20
3AZ	Pressure pipe connection on tandem pump	E32, E34	31
4AZ	Nuts on angled joint of regulating linkage	E32, E34	3
5AZ	Regulating arm to stabilizer	All	9
6AZ	Nut on regulating rod threads	E32	2
7AZ	Ride level control valve holder to rear axle	M8 E32, E34	22
		M6 E32, E34	9
8AZ	Ride level control valve to holder	E32, E34, E30 touring	9

37 - 2 INTEGRATED SUSPENSION SYSTEMS

Type

Nm

37 14 Electric Components

1AZ Wheel camber warning switch to console

E32, E34

9

2AZ Angled joint of jointed rod

E32, E34

5

3AZ Hydraulic switch to distributor

E24, E32

25

4AZ Hydraulic switch to hydraulic control unit

E24, E32

27

5AZ Solenoid valve to hydraulic control unit

E24, E32

55

37 21 Pressure Reservoir

1AZ Pressure reservoir to body

All

9

51 - 1 BODY EQUIPMENT		Type	Nm
51 11	Front Bumper		
1AZ	Bumper to bracket	M6 E32	9
		M8 E36	22
		M10 E34	43
2AZ	Bumper with bracket to Impact absorber	M10 E31	22 *
		M10 E36	55 *
		M12 E30 mod. '88, E32, E34	48
3AZ	Impact absorber / bracket to engine carrier	E30, E24	23
		M6 E31, E32, E34, E36	9
		M10 E32, E34	48

* Install bolts with bolt cement

51 - 2 BODY EQUIPMENT

Type

Nm

51 11 Front Bumper

4AZ Bumper to side panel

E30

7

5AZ Bracket to side panel

E36

6

**6AZ Bumper support
(behind front fog lamp)**

E36

3

7AZ Front fog lamp bracket

E36

2.5

51 - 3 BODY EQUIPMENT

		Type	Nm
51 12	Rear Bumper		
1AZ	Bumper to bracket	M10 E31	40
		M8 E32, E34, E36	22
		M10 E34	42
2AZ	Bumper with bracket to Impact absorber	M10 E36	42 *
		M12 E30 mod. '88, E31, E32, E34	48
3AZ	Impact absorber / bracket to body	E30, E24	23
		M6 E31, E32, E34	9
		M8 E36	22

* Install bolt with bolt cement

51 - 4 BODY EQUIPMENT		Type	Nm
51 12	Rear Bumper		
4AZ	Bumper to side panel	E30	7
5AZ	Bracket to side panel	E36	3
6AZ	Lower trim panel bracket to body	E36	8.5
7AZ	Lower trim panel screw	E36	2.5

51 - 5 BODY EQUIPMENT		Type	Nm
51 16	Mirrors, Finishers, Ashtrays, Consoles		
1AZ	Mirror to front door	E31, E36	6
2AZ	Center console plastic nut	E30	5
51 21	Front Door Locks		
1AZ	Door lock to front door	E31, E36	9 *
2AZ	Outside handle to front door	E31, E36	10
3AZ	Door striker to body	E24, E30	24
		E31, E32, E34	28

* Install bolt with bolt cement.

51 - 6 BODY EQUIPMENT		Type	Nm
51 22	Rear Door Locks		
1AZ	Door lock to rear door	E36	9 *
2AZ	Outside handle to rear door	E36	10
3AZ	Door striker to body	E32, E34	24
51 26	Central Lock Drive		
1AZ	Central lock drive to lock	All	2

* Install bolt with bolt cement.

54 - 1 SUN ROOF / TOP

		Type	Nm
54 12	Mechanical Sun Roof Components		
1AZ	Cable cover to cassette	E36	1.3
2AZ	Lid to gate	All	6 *
		E34 touring	5 *
3AZ	Rail to cassette	M4 E31, E32, E34	1.8
		M5 E32, E34	2.8
4AZ	Cable cover to cassette	E36	1.3
5AZ	Floating roof liner to gate	E36	3.5
6AZ	Cassette to body	M5 E34 touring, E36	3.5

* Replace screw or nut.

54 - 2 SUN ROOF / TOP		Type	Nm
54 13	Electric Sun Roof Components		
1AZ	Motor to cassette	E31, E32, E34, E36	2.8
		E34 touring	3.5
54 34	Power Convertible Top		
1AZ	Hydraulic pipes on electric/hydr. top	E30	8.5
2AZ	Valves on hydraulic control unit	E30	2.0

54-3 Tilt sunroof, convertible top

			Type	Nm
54 34	Electrically operated convertible top			
3AZ	Motor and gear unit Top actuating mechanism to body/mount		E 30	10
4AZ	Motor and gear unit Top actuating mechanism to body		E 30, E 36	10*
5AZ	Drive lever to motor and gear unit	M 6	E 30	3
6AZ	Crank arm to motor and gear unit	M 12	E 30	12,5
7AZ	Slide rods to drive lever	M 4	E 30	1,2
8AZ	Slide rods to convertible top	M 10	E 30	25

* Coat bolts with locking fluid prior to assembly

61 - 1 GENERAL ELECTRICAL SYSTEM

Type

Nm

61 13 Plug Connections

1AZ Door plug connection to body

All

5

**2AZ Fuse box
Screws for safety fuse**

M6

All

5

**3AZ Ground or positive connection
points**

All

5

61-2 General vehicle electrical system

			Type	Nm
61 31	Switches			
1AZ	Temperature switch	91 °C	all	14
		99 °C	all	14
2AZ	Oil pressure switch		M 10, M 40, M 42 M 21, M 51 M 20, M 30, M 50 M 60, M 70, S 70	40
	Note: Lubricate threads		M 88-3, S 14, S 50, S 38 M 43	20
3AZ	Reversing lamp switch		all	20
4AZ	Light switch on instrument panel		E 36	2
5AZ	Transmission switch to shift console		all	4.5

61 - 4 GENERAL ELECTRICAL SYSTEM

			Type	Nm
61 61	Windshield Wipers			
1AZ	Wiper motor to wiper console	M6	E31	6
			E36	10
2AZ	Parked position stop to wiper console		E31	15
3AZ	Wiper contact pressure motor to wiper console		E31	6
4AZ	Motor crank to wiper motor	M8	All	27
5AZ	Wiper shaft nut to body		E31, E36, E32, E34	12
6AZ	Holder to firewall	M6	E31	9
	screws in firewall		E36 Coupe	10

<div>62 - 1</div> <div>INSTRUMENTS</div>	Type	Nm
<div>62 16</div> <div>Car Electrical System Senders</div>		
<div>1AZ</div> <div>Screws for speedometer sender</div>	All	6.6 ... 8.4

64 - 1 HEATER AND AIR CONDITIONER

		Type	Nm
64 12	Additional Heater with Controls		
1AZ	Additional heater to body floor	All	4.5
2AZ	Glow plug	E24	17.5
		E31, E32, E34	4
3AZ	Temperature sensor	E31, E32, E34	0.5
4AZ	Oil control plug and oil filler plug	All	16
5AZ	Mounting screws	M5 All	6
		M6 All	10
		M8 All	24
		M10 All	48
6AZ	Screws for filter cover	All	0.9

64 - 2 HEATER AND AIR CONDITIONER		Type	Nm
64 21	Air and Water Hoses / Pipes		
1AZ	Studs on heat exchanger	E36	3
2AZ	Studs on double-pipe	E36	2
3AZ	Nuts on double-pipe	E36	3.5
64 51	Air Conditioner (Evaporator), Control Units		
1AZ	High / medium pressure presso- stat	All	25 *
2AZ	Low pressure pressostat	All	19 *
3AZ	Three-way safety switch	All	25

* Bolt cement, Part No. 81 22 9 407 144

64-3 Heating and air conditioning

64-3 Heating and air conditioning		Type	Nm
64 52	Compressor		
1AZ	Compressor to engine	all	22
2AZ	Solenoid clutch spring plate	all	20
3AZ	Torque wrench pretension for new poly-V-belt	M40, M42, M43, M51	7...8.5
		S50	16...17
	for used poly-V-belt	M40, M42, M43, M51	5...6.5
		S50	12
4AZ	Special tool pretension for new poly-V-belt	M40, M42, M43, M51	77...83 scale graduations
		S50	100 scale graduations
	für gelaufene Keilrippenriemen	M40, M42, M51	66...73 scale graduations
		S50	70 scale graduations

64 - 4 HEATER AND AIR CONDITIONER

		Type	Nm
64 53	Condenser and Drier with Pipes		
1AZ	Pipe connections	5/8" All	20
		3/4" All	39
		7/8" All	42
		1 1/16" All	48

65 - 1 RADIO AND SPECIAL EQUIPMENT		Type	Nm
65 11	Radio		
1AZ	Headless screw for radio installation	All	0.5

72 - 1	EQUIPMENT AND ACCESSORIES FOR BODY	Type	Nm
72 11	Seat Belts		
1AZ	Seat belt to body or seat	All	48
2AZ	Belt height control bolts	All	24
3AZ	Seat belt to seat	E31	47 *
4AZ	Seat belt to backrest	E31	24
5AZ	Headrest to backrest	E31	24

* Install bolt with bolt cement